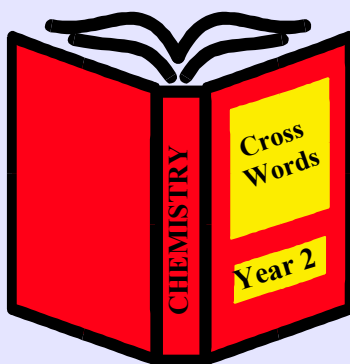


# **Further Quick Revision Crosswords**

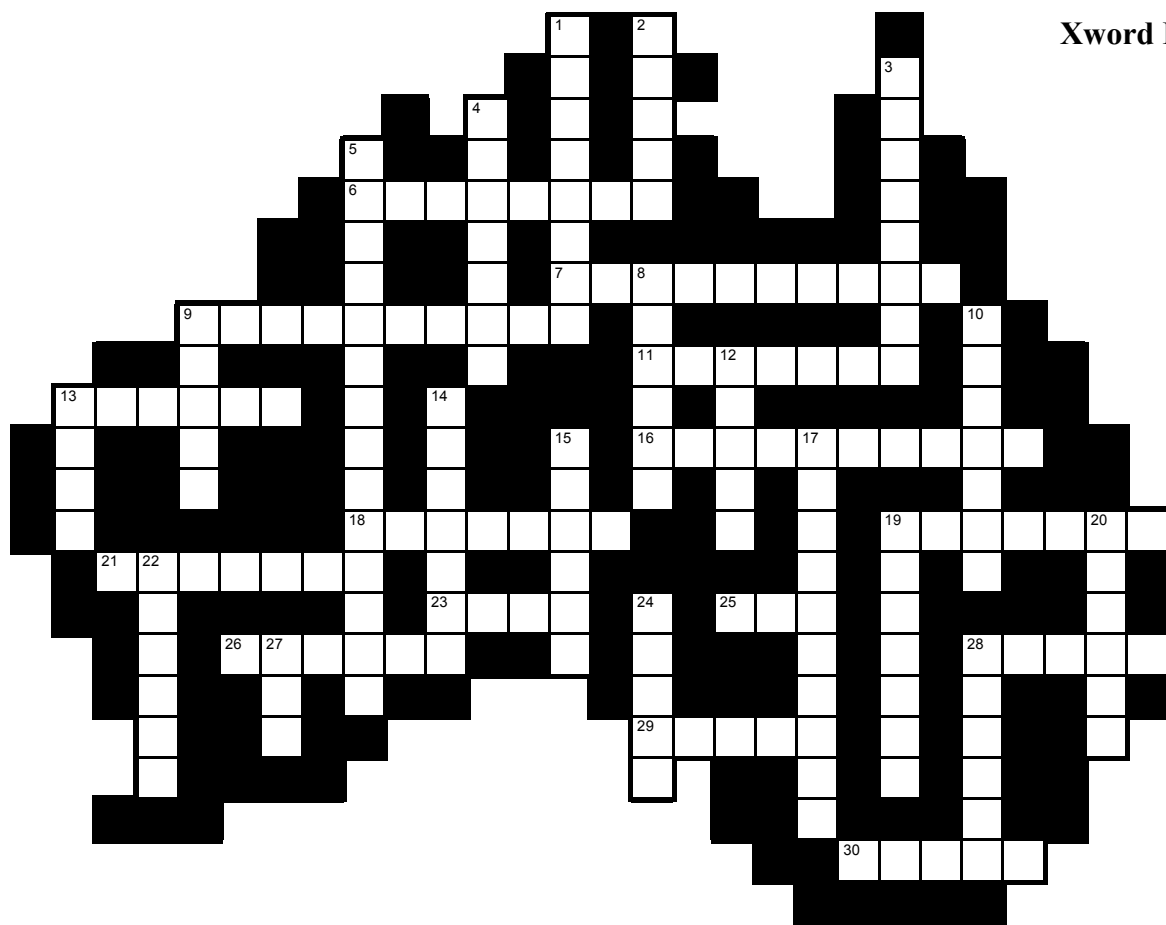
## **Second Year GCE A level Chemistry**

### **Puzzles & Solutions**

**Each of these crosswords draws on material  
selected from the whole of GCE A level  
Chemistry**



# PUZZLES:



Xword I

## Across

- 6 An ore of iron. (8)  
 7 The dextrorotatory form occurs in tired muscle tissue. (10)  
 9 pH of 0.5M HCl (5,5). (10)  
 11 Formed by the action of the enzyme, diastase on starch. (7)  
 13 Made from lime and sand. (6)  
 16 A fertilizer consisting of calcium carbonate and ammonium nitrate. (10)  
 18 Knocking. (7)  
 19 A property of sodium hydroxide. (7)  
 21 The representation of the smallest part of a compound. (7)

- 23 An important fertilizer. (4)  
 25 Potash. (3)  
 26  $[\text{Xe}]6s^2$ . (6)  
 28 Measure of the activity of a radioactive substance. (5)  
 29 The number 3 in,  $\text{rate} = k[\text{A}]^3$  (5)  
 30 Saltpetre. (5)

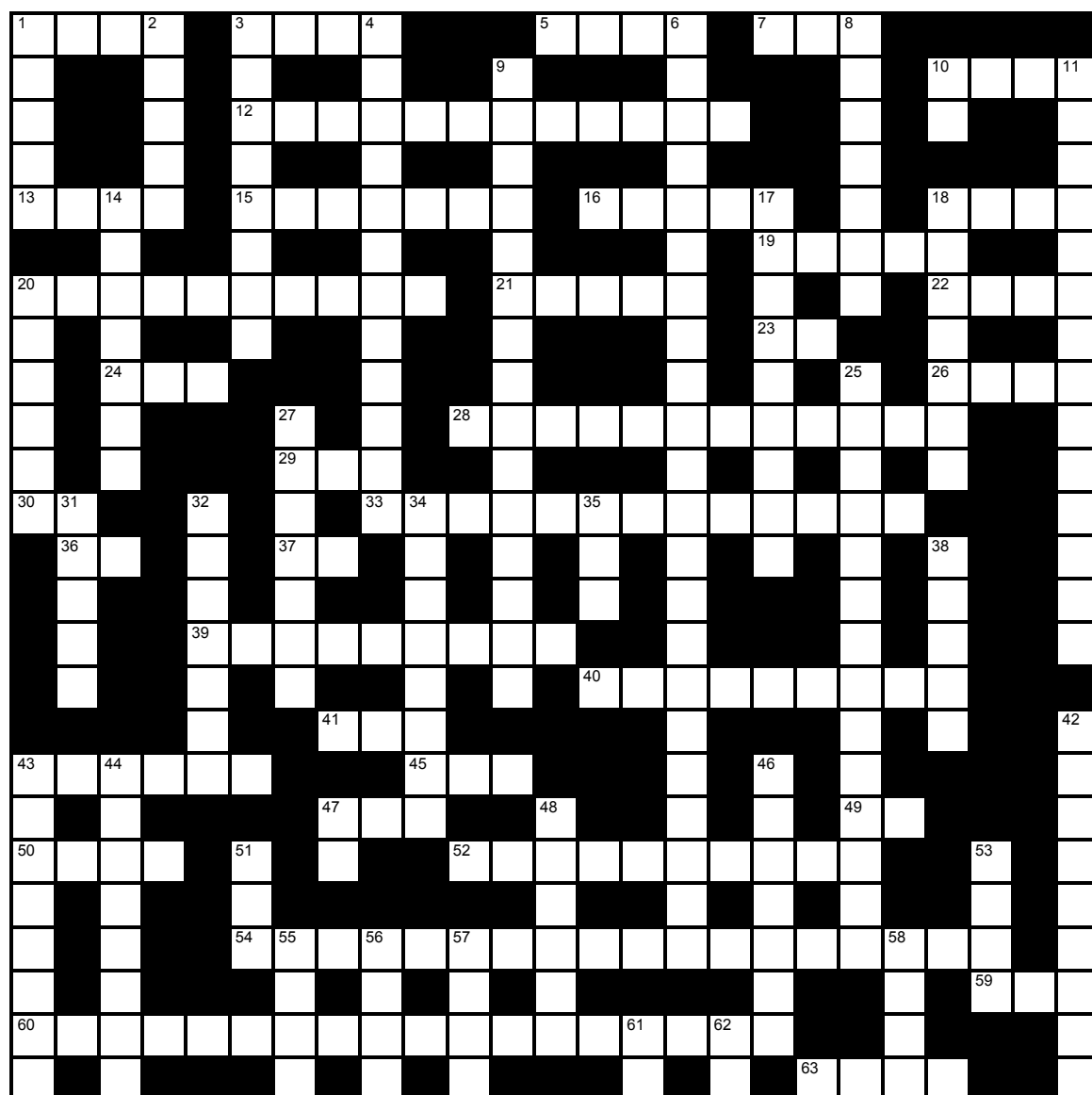
## Down

- 1 A porcelain vessel used to perform high temperature reactions. (8)  
 2 pH of 0.001M  $\text{HNO}_3$ . (5)  
 3 Sodium aluminium fluoride. (8)  
 4 Ammonium cyanate and urea. (7)

- 5 Partially dehydrated gypsum (7,2,5). (14)  
 8 Produced by heating a mixture of limestone and clay and grinding the product to a fine powder. (6)  
 9 A residue from the destructive distillation of wood and coal-tar. (5)  
 10 A positively charged body consisting of protons and neutrons. (7)  
 12 The volume of 1 kilogram of pure water at 4°C and 1 atmosphere pressure. (5)  
 13 Sprouted barley. (4)  
 14 Atomic number 72. (7)

- 15 The shape of the ethyne molecule. (6)  
 17 The shape of the hydrated aluminium (III) ion. (10)  
 19 A solid with a regular geometric form. (7)  
 20 A blue vat dye. (6)  
 22 The concentration when 0.001g of a substance is dissolved in 1000g of water (3,3). (6)  
 24 Used for hardening steel and occurs in borax. (5)  
 27 A class of dyes. (3)  
 28  $[\text{Ar}]3d^{10},4s^1$  (6)

## Xword II



### Across

**1** Formed when silicon combines with oxygen. (4)

**3** A chelating agent. (4)

**5** Adding sulphur trioxide to water produces this physical phenomenon. (4)

**7** The colour of litmus in an aqueous solution of aluminium nitrate. (3)

**10** 1,4-disubstituted benzene. (4)

**12** The separation of charged particles in a liquid. (12)

**13** The number of hydrogen atoms in a 3-chloropentanoic acid molecule. (4)

**15** Randomness of a reacting system. (7)

**16** A small scale industrial process. (5)

**18** Red hydrated oxide of iron. (4)

**19** An organic compound which is basic. (5)

**20** The nature of aluminium oxide. (10)

**21**  $\text{RCONH}_2$ . (5)

**22** Glycol is an example. (4)

**23** Next in the series, Sc, Ti, V, Cr. (2)

**24** The atomic number of neon. (3)

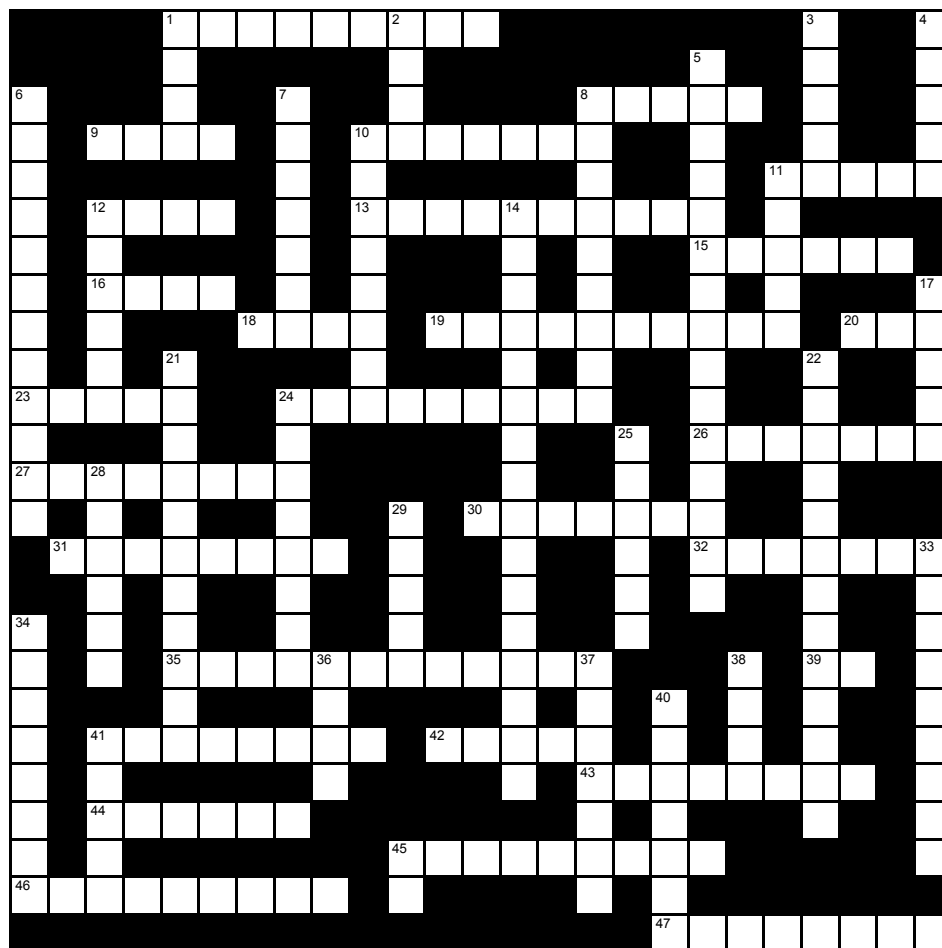
**26** Secondary alcohol group. (4)

**28** Formed when phosphorus(V) chloride reacts with ethanol. (12)

**29** The hydrolysis of

- 2-bromo-2-methylpropane has this molecularity. (3)
- 30 An important, but toxic, fuel. (2)
- 33 The reaction of the hydrated copper(II) ion with hydroxide ion involves this process. (13)
- 36 Which metal has a unipositive ion with the largest charge density, Li or Rb. (2)
- 37  $14 - \text{pOH}$  (2)
- 39 Charge on an aluminium ion (4, 5). (9)
- 40  $[\text{He}]2s^2$  (9)
- 41 Calcium carbonate forms an equilibrium mixture when heated in a sealed tube. How many partial pressure terms are there in the expression for  $K_p$ ? (3)
- 43 Which does not contain copper, solder, brass, duralumin, bronze? (6)
- 45 The electrical energy produced per unit charge inside a battery. (3)
- 47 Reacted with halogenoalkanes in a stepping up synthesis. (3)
- 49 The streets of London are not paved with this. (2)
- 50 In group four. (4)
- 52 A type of distillation. (10)
- 54 A property of these elements is that they form coloured compounds. (18)
- 59 Standard temperature & pressure. (3)
- 60 The one having the highest boiling point, tetrachloromethane, chloromethane or trichloromethane? (18)
- 63 A solution of this forms a blood red colour with aq iron(III). (4)
- Down**
- 1 In the pmr spectrum of an aromatic compound the phenyl group absorbs at approximately this ppm value. (5)
- 2 Contains two carbon-carbon double bonds. (5)
- 3 The standard enthalpy of formation refers to a reaction between ----- in their normal states. (8)
- 4 Vitamin C. (8,4)
- 6 The pH of 0.123M barium hydroxide solution (8,5,5,4). (22)
- 8 We use this adjective to describe a reversible reaction at equilibrium. (7)
- 9 Constructed from simple sugars. (15)
- 10 A weak of covalent bond. (2)
- 11 Formed by reacting ethanoic acid with thionyl chloride. (14)
- 14 An oil fraction containing compounds which have 6 to 10 carbon atoms per molecule. (7)
- 17 An iron ore. (9)
- 18 Copper ions having gained electrons. (7)
- 20 Acid-base character of silicon(IV) oxide. (6)
- 25 The amount of heat evolved by the combustion of unit mass of substance (9,5). (14)
- 27 A element which exists in octagonal rings. (7)
- 31 Very concentrated sulphuric acid. (5)
- 32 Combines with bromine to give 1,2-dibromopropane. (7)
- 34 The atomic number of argon. (8)
- 35 Beryllium is in this group in the periodic table. (3)
- 38 A type of covalent bond. (5)
- 42 Calcium fluoride. (9)
- 43 Chlorine reacts with aq thiosulphate to give hydrochloric acid and what else? (8)
- 44 We say this is how molecules enter the ionisation chamber of a mass spectrometer (4,4). (8)
- 46 Which of the following is unsaturated: ethane, ethanol, propanone, benzene, ethanoic acid. (7)
- 47 Iodine is sparingly soluble in water but much more soluble in an aqueous solution of this salt. (2)
- 48 A bond in ammonium chloride. (6)
- 51 A white powder used as an insecticide. (3)
- 53 The energy transfer in a chemical reaction equals specific heat capacity multiplied by temperature change and one other value. (4)
- 55 General formula of a class of compound which reacts with Tollen's reagent & gives an orange precipitate with Brady's reagent. (4)
- 56 This hydroxide is deliquescent. (4)
- 57 This metal produces green and yellow ions. (4)
- 58 A monoatomic gas that signs a message. (4)
- 61 Etches glass. (2)
- 62 An oxide of nitrogen. (2)

## Xword III



### Across

- 1 Can be hammered into thin sheet. (9)  
 8 Type of reaction of chlorine with water. (5)  
 9 Some of these insects produce formic acid for defence purposes. (4)  
 10 Which of the following is sometimes represented as a triene: ethane, ethanol, propanone, benzene, ethanoic acid. (7)  
 11 In the pmr spectrum of an aromatic compound the phenyl group absorbs at approximately this ppm value. (5)  
 12 Secondary alcohol group. (4)  
 13 Resulting from the thermal decomposition of PVC (5,5). (10)  
 15 Mixtures such as iron and carbon and copper and zinc. (6)  
 16 The colour of the Mn(II) ion. (4)  
 18 Internally compensated tartaric acid. (4)  
 19 Made by oxidising ammonia (6,4). (10)  
 20 The number of stereoisomers formed when hydrogen bromide reacts with but-2-ene. (3)  
 23 The number of methyl groups in, 2-chloro-4-methylpentane. (5)  
 24 It has about 600 times the sweetening power of sucrose. (9)  
 26 A mixture of equal amounts of dextro and laevo rotatory butan-2-ol. (7)  
 27 A group which absorbs in the infra

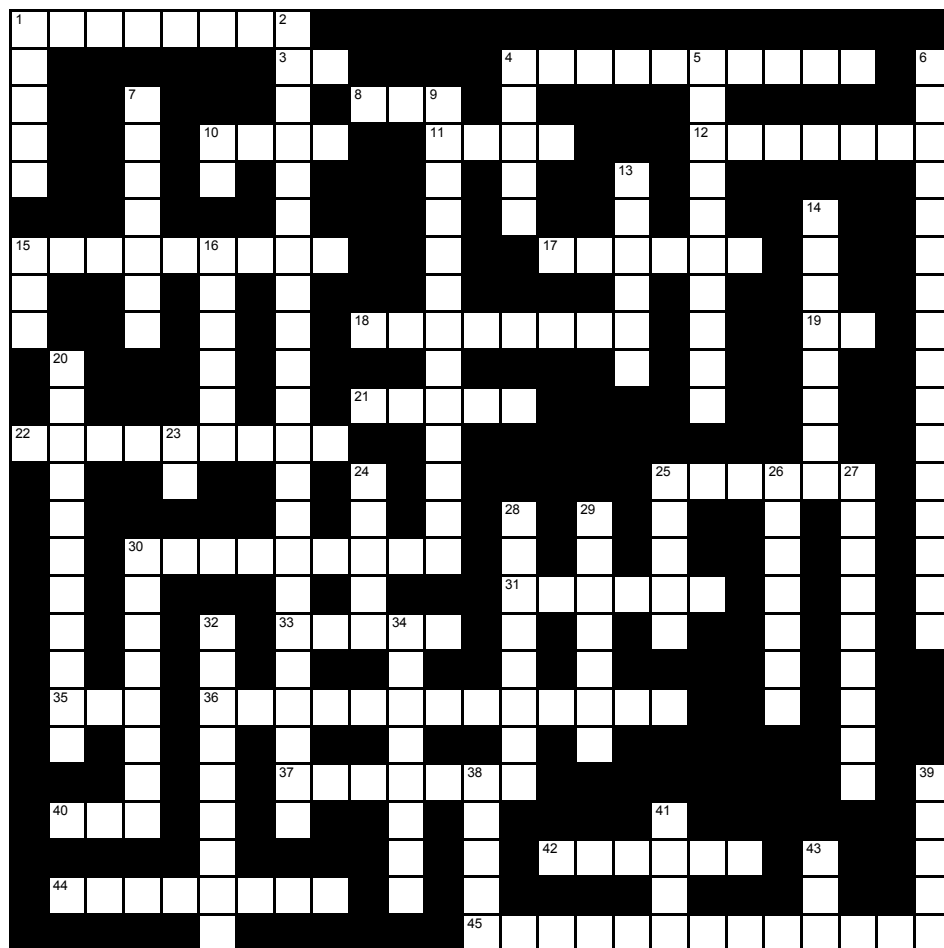
- red at about 1700 wavenumbers. (8)  
 30 Ionising electrons do this to molecules in the mass spectrometer. (7)  
 31 The type of carbon chain in butane. (8)  
 32 A measure of the degree of disorder of a system. (7)  
 35 In the dehydration of 10g of cyclohexanol 6g of cyclohexene was produced. What was the % yield? (12)  
 39 Which requires most energy, the breaking of the HH bond or the breaking of the FF bond? (2)  
 41 The type of reaction occurring when ethene reacts with bromine. (8)  
 42 A small scale industrial process. (5)  
 43 A type of pollution caused by certain non-metal oxides in the atmosphere (4,4). (8)  
 44 Which has the largest atom, sodium or iodine? (6)  
 45 Anti cancer drug. (9)  
 46 The bond angle in beryllium chloride. (9)  
 47 A conducting form of carbon. (8)

### Down

- 1 Adding sulphur trioxide to water produces this physical phenomenon. (4)  
 2 The colour of anhydrous cobalt(II) chloride. (4)  
 3 Contains two carbon-carbon double bonds. (5)  
 4 The colour of manganese(IV) oxide. (5)  
 5 Starch and cellulose are examples. (15)  
 6 A model chemical structure which shows bond angles but not relative atom sizes (4,3,5). (12)  
 7 In order for molecules to react they must? (7)  
 8 Addition of hydrogen. (9)  
 10 Ethyl ethanoate is isomeric with this acid. (8)  
 11 Physical state of polyethene at room temperature. (5)  
 12 Which has the highest density, Rb or Cu? (6)  
 14 Melting point and boiling point (8,2,6). (10,6)  
 17 The type of compound formed when sodium and chlorine combine. (5)  
 21 A term used to describe the arrangement of electrons in structures like the nitrate ion and the buta-1,3-diene molecule. (11)  
 22 Type of addition involving halogen and alkene. (13)  
 24 A barium salt is used to test for this anion. (8)  
 25 Flat. (6)  
 28 We say that it is difficult to do this to carbon atoms attached to one another by a double bond. (6)

- 29 In the preparation of cyclohexene from cyclohexanol why is it necessary to add calcium chloride in the final stage? (2,3). (5)  
 33 Fluorine colour. (9)  
 34 We say this is how molecules enter the ionisation chamber of a mass spectrometer (4,4). (8)  
 36 An electric discharge through this gas at low pressure produces an orange-red glow. (4)  
 37 This compound is very pungent and smells of rotten apples. Its molecule contains two carbon atoms, four hydrogen atoms and an oxygen atom. (7)  
 38 If you were to write the ionic equation for the reaction of potassium with bromine how many ions would the equation contain? (4)  
 40 Occurs when a liquid is hot enough for bubbles of vapour to form in the body of the liquid. (7)  
 41 This class of compound contains an NRR group where R represents hydrogen and/or alkyl groups which can be the same or different. (5)  
 45 This oxide converts iron(III) oxide to iron and carbon dioxide. (2)

## Xword IV



### Across

- 1 Stop the titration at this stage (3,5). (8)
- 3 Etches glass. (2)
- 4 The burning of ethanol in excess oxygen is one example. (10)
- 8 The electrical energy produced per unit charge inside a battery. (3)
- 10 1,4-disubstituted benzene. (4)
- 11 Absorbs in the pmr spectrum at about 10 ppm. (4)
- 12 Combines with bromine to give 1,2-dibromopropane. (7)
- 15 The iodide ion in magnesium iodide. (9)
- 17 The colour observed when a sodium salt is heated in a bunsen flame. (6)
- 18 0.693/k (8)
- 19 A good investment? (2)
- 21 The number of electrons in a lithium atom. (5)
- 22 Combines with hydrogen bromide to give 2-bromobutane. (9)
- 25 When the dioxides of potassium and carbon react they produce potassium carbonate and this gas. (6)
- 30 At a particular temperature 0.2

- mol dinitrogen tetroxide dissociated to nitrogen dioxide. At equilibrium 0.1 mol of the tetroxide remained and the total pressure was 0.5 atm. What is the value of Kp in atm (3,6)? (9)
- 31 An indicator. (6)
- 33 Pleasant smelling. (5)
- 35 A white powder used as an insecticide. (3)
- 36 Sulphuric acid and the hydrogensulphate ion (9,5). (13)
- 37 An aqueous solution at pH 7. (7)
- 40 Reacted with halogenoalkanes in a stepping up synthesis. (3)
- 42 An acid which is completely ionised in aq solution. (6)
- 44 The standard enthalpy of formation refers to a reaction between ----- in their normal states. (8)
- 45 Typical substitution reaction of aromatic species. (13)

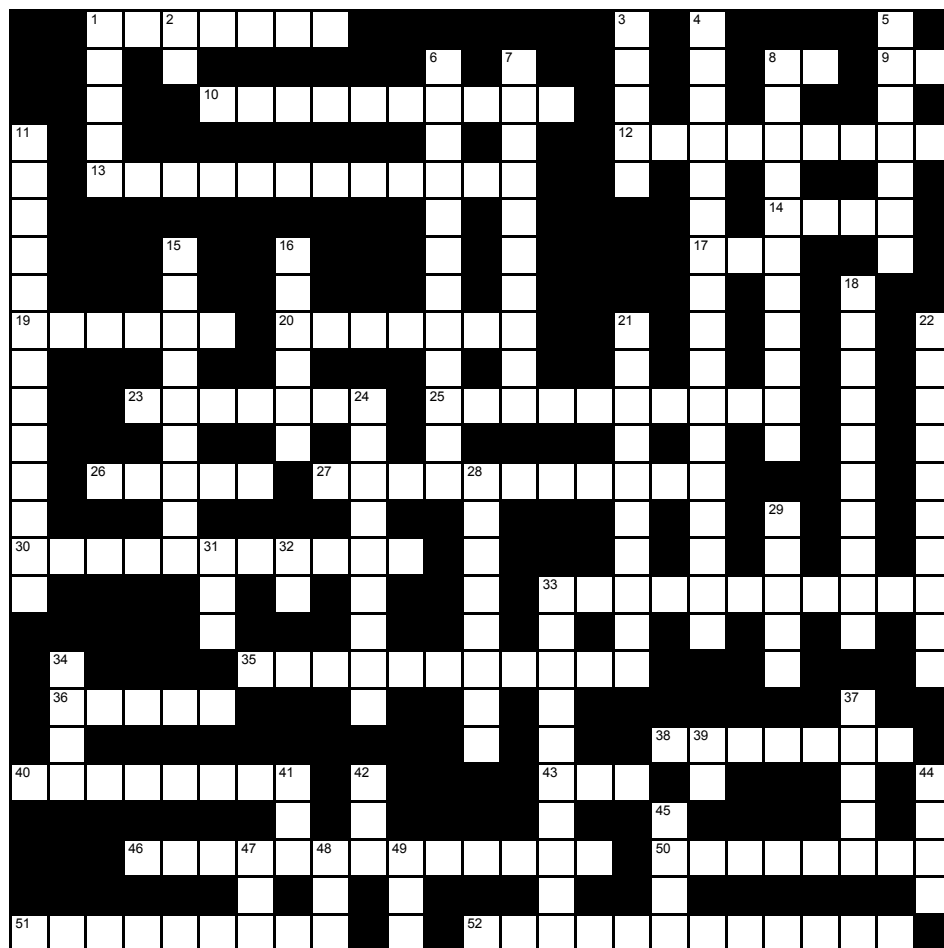
### Down

- 1 The number of hydrogen atoms in the methylbenzene molecule. (5)

- 2 The pH of 0.245M NaOH solution (8,5,5,4). (22)
- 4 The molecular formula of 2,2,4-trimethylpentane. (5)
- 5 Potassium dioxide is an example of one of these. (10)
- 6 The pH of  $5.01 \times 10^{-13}$  M HCl (6,5,5). (16)
- 7 Amide degradation. (7)
- 9 An organic reaction employing anhydrous aluminium chloride (7,6). (13)
- 10 14 - pOH (2)
- 13 The substance deposited when zinc powder is added to aqueous silver nitrate. (6)
- 14 In the zinc-hydrogen cell this is the charge on the zinc electrode. (8)
- 15 Chlorine is used in the manufacture of this plastic. (3)
- 16 An element originally extracted from seaweed. (6)
- 20 The common name for NaOH (7,4). (11)
- 23 An oxide of nitrogen. (2)
- 24 +420 kJ per mol is an ionisation energy of potassium. Is it the first or the second? (5)

- 25 Very concentrated sulphuric acid. (5)
- 26 A disadvantage of butane as a motor fuel. (7)
- 27 An ion which reacts with benzene to give nitrobenzene. (9)
- 28 Copper metal dipping into copper(II) sulphate solution is an example (4,4). (8)
- 29 A four carbon aldehyde. (7)
- 30 The number of moles of oxygen required to completely combust two moles of butane. (8)
- 32 Effect on  $K_w$  when the temperature is raised. (9)
- 34 The atomic number of argon. (8)
- 38 An organic compound which is basic. (5)
- 39 When pH is greater than 7. (5)
- 41 The number of neutrons in a lithium atom. (4)
- 43 The hydrolysis of 2-bromo-2-methylpropane has this molecularity. (3)

## Xword V



### Across

- 1 Gives a dark blue solution with copper(II) sulphate. (7)
- 8 The molecularity involved in the hydrolysis of bromoethane. (2)
- 9 An oxide of nitrogen. (2)
- 10 Bipolar ion. (10)
- 12 The sulphate of this alkaline earth metal is 10000 times less soluble in water than magnesium sulphate. (9)
- 13 0K (8,4). (12)
- 14 A chelating agent. (4)
- 17 The atomic number of neon. (3)
- 19 Allotrope of ozone. (6)
- 20 An energy change which, along with enthalpy of hydration, accounts for the solubility in water of a crystalline solid. (7)
- 23 The physical state of mercury at 380°C. (7)
- 25 Surface attraction. (10)
- 26  $RCONH_2$ . (5)
- 27 A highly corrosive sodium salt (7,4). (11)
- 30 An atom or group which can provide a pair of electrons to form a covalent bond. (11)
- 33 An intermediate structure

containing a carbon atom carrying a single positive charge. (11)

- 35 The energy change when an atom is ionised. (11)
- 36 Pyrosulphuric acid. (5)
- 38 An oil fraction containing compounds which have 6 to 10 carbon atoms per molecule. (7)
- 40 Organomagnesium reagent. (8)
- 43 760 mm Hg pressure and 0°C. (3)
- 46 Mode of addition. (13)
- 50 The atomic number of argon. (8)
- 51 The covalent bonds in the water molecule. (9)
- 52 This results from the unequal sharing of a bonding pair (4,8). (12)

### Down

- 1 The type of amino acid comprising animal protein. (5)
- 2 Next in the series, Sc, Ti, V, Cr. (2)
- 3 +420 kJ per mol is an ionisation energy of potassium. Is it the first or the second? (5)

- 4 A process for purifying an impure solid compound. (17)

- 5 The structure of the sulphur dioxide molecule is not planar. (7)

- 6 Species involved in the reaction of methane with chlorine in the presence of sunlight (4,8). (12)

- 7 The colour of vanadium(V) fluoride. (10)

- 8 Phenylamine. (11)

- 11 This applies to Bakelite. (13)

- 15 An iron ore. (9)

- 16 The colour observed when a sodium salt is heated in a bunsen flame. (6)

- 18  $R_2C(OH)CN$ . (10)

- 21 The nature of aluminium oxide. (10)

- 22 Distillation used to separate a complex liquid mixture. (10)

- 24 One reason why helium has a very large ionisation energy. (9)

- 28 The number of electrons in an aluminium atom. (8)

- 29 A state of matter. (5)

- 31 Calcium carbonate forms an equilibrium mixture when heated in a sealed tube. How many partial pressure terms

are there in the expression for  $K_p$ ? (3)

- 32 Boils at 19.5°C and is extensively hydrogen bonded in the liquid phase. (2)

- 33 The burning of ethanol in excess oxygen is one example. (10)

- 34 The number of neutrons in a lithium atom. (4)

- 37 Oxygen atoms in 2-oxopropanoic acid. (5)

- 39 A solution of sodium cyanide can be used to isolate this metal from alluvial sands. (2)

- 41 Used in the second World War for delousing!. (3)

- 42 Beryllium is in this group in the periodic table. (3)

- 44 Impure silica. (4)

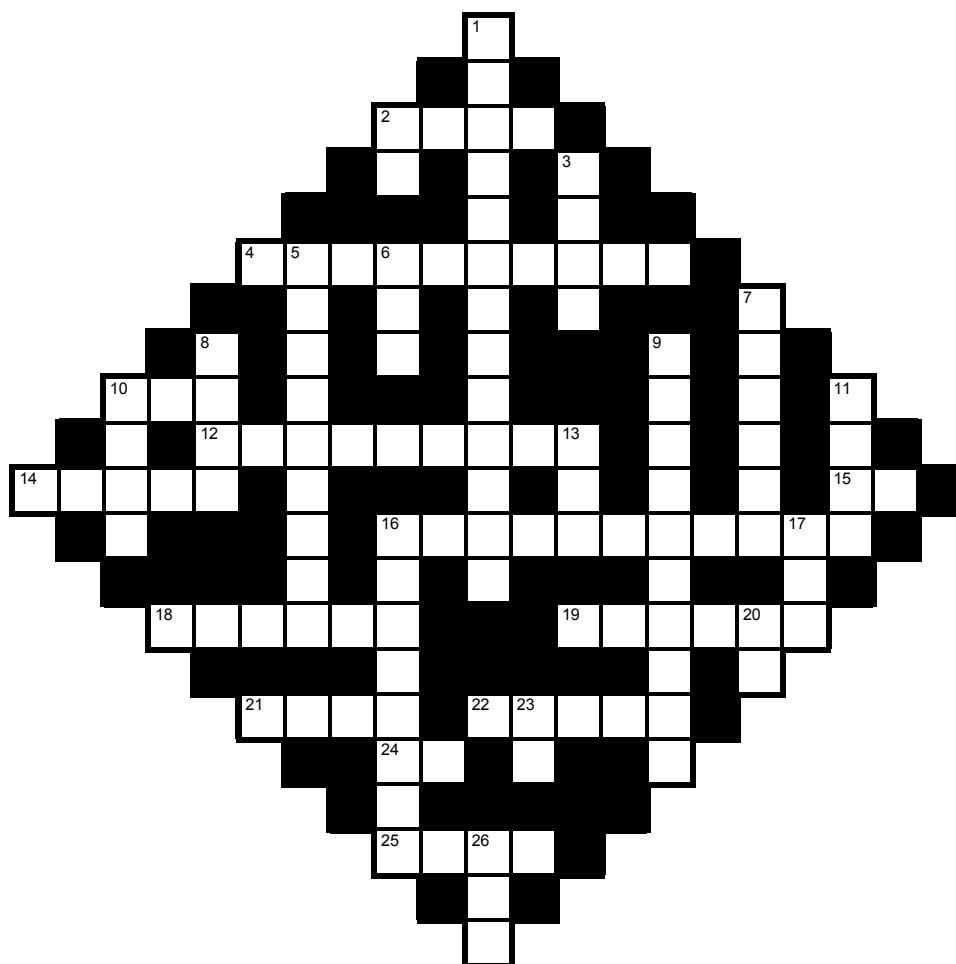
- 45 In the reaction of propanone with iodine, the order with respect to iodine. (4)

- 47 Form of geometrical isomer. (3)

- 48 The colour of litmus in an aqueous solution of aluminium nitrate. (3)

- 49 Chlorine is used in the manufacture of this plastic. (3)

## Xword VI



### Across

- 2 A solution of this forms a blood red colour with aq iron (III). (4)  
 4 Natural gas and coal are examples (6,4). (10)  
 10 Has been used in the fight against malaria. (3)  
 12 This is particularly strong in the case of Al and helps prevent the metal corroding (5,4). (9)  
 14 Fuming sulphuric acid. (5)  
 15 Prepared by the catalytic oxidation of ammonia. (2)  
 16 A region of the atmosphere. (11)  
 18 Relights a glowing splint. (6)

- 19 Arrest a reaction. (6)

- 21 When a solution of silver nitrate is added to brine this compound is precipitated. (4)  
 22 The number of covalent bonds in a nitrogen molecule. (5)  
 24 A yellowish metal. (2)  
 25 Has been used to treat lead poisoning. (4)

### Down

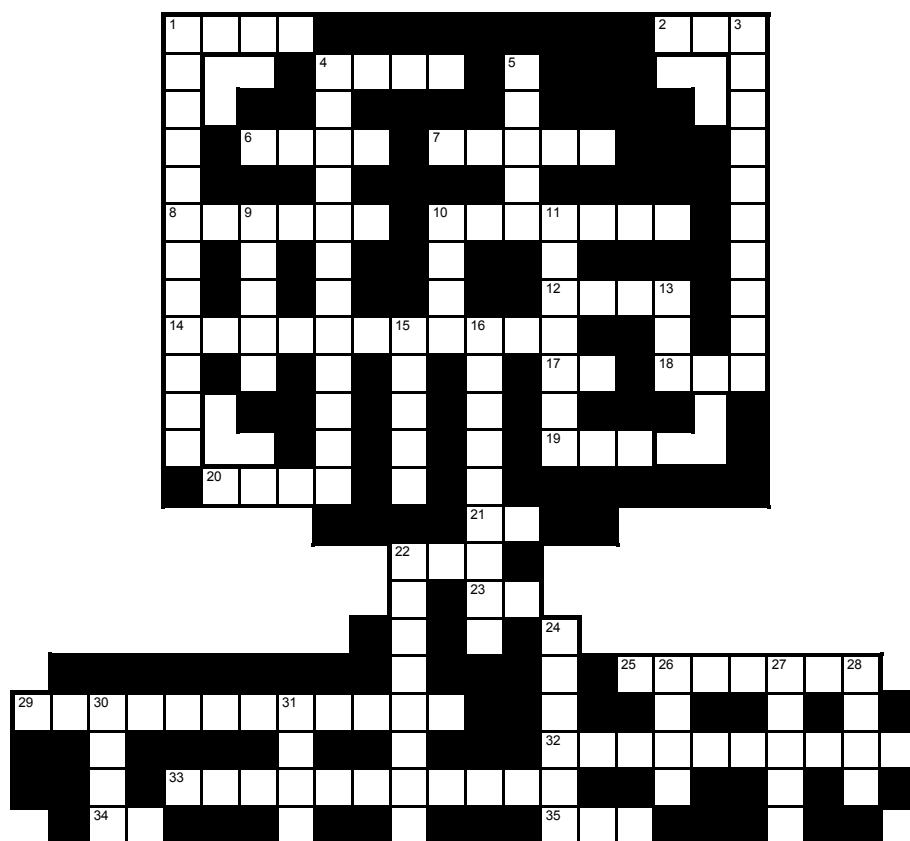
- 1 A common name for phenylmethanol (6,7). (13)  
 2 Iodine is sparingly soluble in water but much more soluble in an aqueous solution of this salt. (2)

- 3 The number of *s* electrons in a beryllium atom. (4)  
 5 A property of lead (IV) oxide. (9)  
 6 Standard temperature & pressure. (3)  
 7 Nozzle through which air is blown. (6)  
 8 The smallest particle of an element. (4)  
 9 This family of elements all have coloured molecules (5,5). (10)  
 10 Compounds used to colour materials such as, leather, cotton, wool, silk. (4)

- 11 The number of hydrogen atoms in a 3-chloropentanoic acid molecule. (4)  
 13 Beryllium is in this group in the periodic table. (3)  
 16 Extensively used for making cans for food and drink (3,5). (8)  
 17 A general formula for an alcohol. (3)  
 20 An important, but toxic, fuel. (2)  
 23 A halogen hydride. (2)  
 26 The number of electrons a magnesium ion. (3)



## Xword VII



### Across

- 1 Used in titrimetric analysis to estimate metal ions. (4)
- 2 A halogen containing plastic. (3)
- 4 Glycol is an example. (4)
- 6 Formed in qualitative analysis when testing for chloride ion. (4)
- 7 A state of matter. (5)
- 8 A solution of iodine in the organic solvent, dichloromethane, has this colour. (6)
- 10 It is what happens to iron when concentrated nitric acid is added to it. (7)
- 12 In group four. (4)
- 14 The common name for NaOH (7,4). (11)
- 17 Formed when mercury is shaken with concentrated sulphuric acid containing some potassium nitrate. (2)
- 18 The number of electrons a sodium ion. (3)
- 19 Normal temperature & pressure. (3)

20 Used as a standard solution in the Volhard titration to estimate silver ion. (4)

21 Forms a stable and harmful complex with haemoglobin. (2)

22 Radium is in this group in the periodic table. (3)

23 Element number 79. (2)

25 Very hard and can be a variety of colours. (7)

29 This results from bonded atoms having different electronegativities(4,8). (12)

32 Graphite and diamond. (10)

33 The energy change when citric acid reacts with aqueous sodium hydrogencarbonate. (11)

34 Etches glass. (2)

35 Smells of bad eggs (1,2,1)! (3)

### Down

1 This occurs when dilute hydrochloric acid is added to sodium carbonate solution. (12)

3 Self linkage (as with carbon). (10)

4 Its what lead nitrate does when heated. (12)

5 An important product derived from sand. (5)

9 Very concentrated sulphuric acid. (5)

10 This is what happens when hydrogen is ignited. (4)

11 Silicon compounds related to the alkanes. (7)

13 Made by reacting trichloromethanal with chlorobenzene. (3)

15 The molecular formula of 2,2,4-trimethylpentane. (5)

16 This is particularly strong in the case of Al and can be thickened by anodizing (5,4). (9)

22 The number of hydrogen atoms in 1-chlorohexane. (8)

24 Disinfectant. (6)

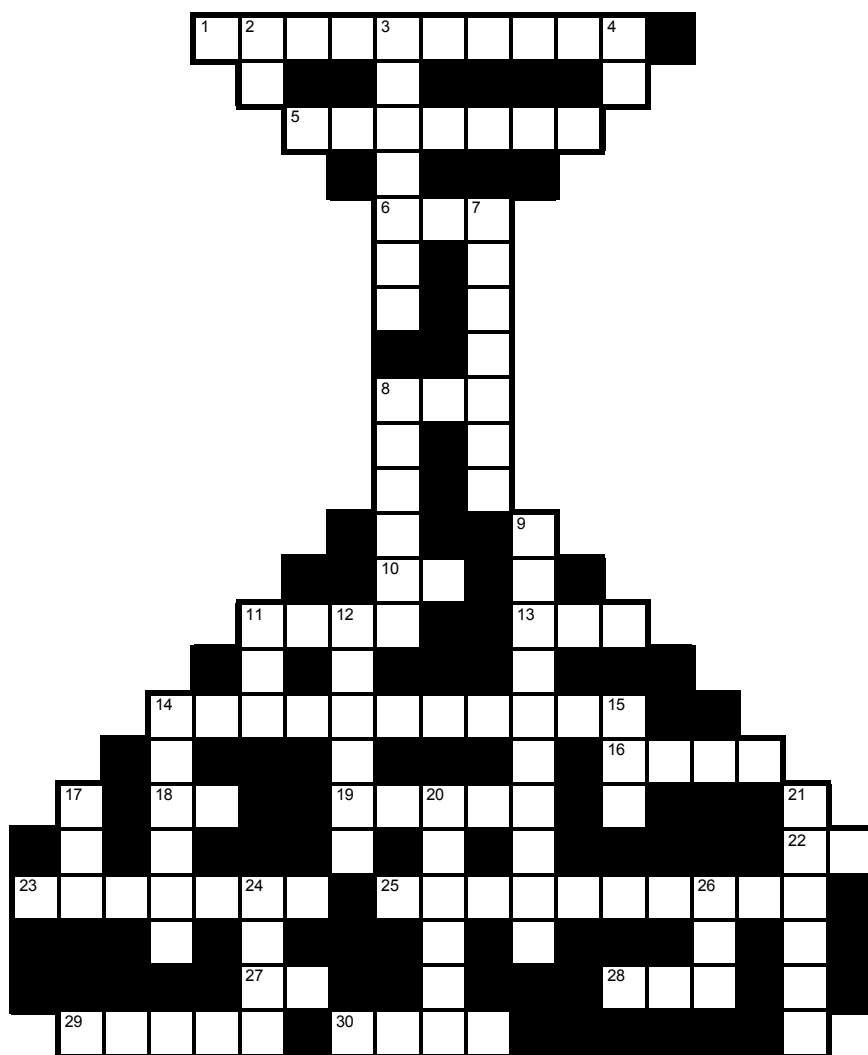
26 This metal produces green and yellow ions. (4)

27 This gas helps prevent harmful radiation reaching the earth's surface. (5)

28 Compounds used to colour materials such as, leather, cotton, wool, silk. (4)

30 This hydroxide is deliquescent. (4)

31 The smallest particle of an element. (4)



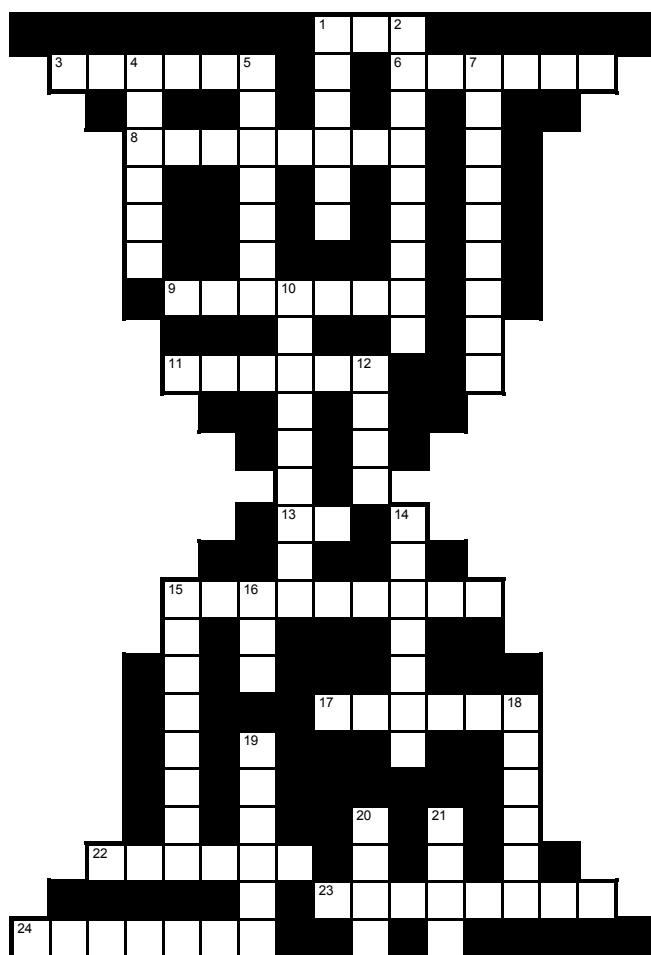
## Xword VIII

### Across

- 1 The nature of aluminium oxide. (10)  
 5 A form of tin which has the diamond structure (4,3). (7)  
 6 Calcium carbonate forms an equilibrium mixture when heated in a sealed tube. How many partial pressure terms are there in the expression for  $K_p$ ? (3)  
 8 Litharge and massicot. (3)  
 10 The missing element; N,P,Sb,Bi. (2)  
 11 The most ionic; ZnS, LiI, AgCl, PbO, CsCl? (4)  
 13 The number of electrons in an aluminium ion. (3)  
 14 The main ore of tin. (11)  
 16 Internally compensated tartaric acid. (4)  
 18 The molecularity involved in the hydrolysis of bromoethane. (2)  
 19 The type of amino acid found comprising animal protein. (5)  
 22 Which metal has a unipositive ion with the largest charge density, Li or Rb. (2)  
 23 Occurs when a liquid is hot enough for bubbles of vapour to form in the body of the liquid. (7)  
 25 Propan-2-ol and propan-1-ol. Examples of this type of structural isomerism. (10)  
 27 The next in the series; B,C,N,O,F,Ne. (2)  
 28 A general formula for an alcohol. (3)  
 29 The pH of  $10^{-3}$  M HCl. (5)  
 30 The colour of the Mn (II) ion. (4)

### Down

- 2 Next in the series, Sc, Ti, V, Cr. (2)  
 3 The amount of gas occupying 22.4 litres at stp (3,4). (7)  
 4 An important, but toxic, fuel. (2)  
 7 Randomness of a reacting system. (7)  
 8 One newton per square metre. (6)  
 9 Made by oxidising ammonia (6,4). (10)  
 11 Form of geometrical isomer. (3)  
 12 Asymmetric. (6)  
 14 A hard, silvery, metal which when alloyed with iron makes excellent permanent magnets. (6)  
 15 The electrical energy produced per unit charge inside a battery. (3)  
 17 Barium is in this group in the periodic table. (3)  
 20 A quantum of light energy. (6)  
 21 Mixtures such as iron and carbon and copper and zinc. (6)  
 24 The number of hydrogen atoms in a 3-chloropentanoic acid molecule. (4)  
 26 A sodium salt containing a hydride ion. (3)



## Xword IX

### Across

- 1 A form of phosphorus which does not catch fire at room temperature. (3)
- 3 Common name for ethanedioic acid. (6)
- 6 A sample of an organic compound melts at 5°C below its true melting point. What can be concluded about the nature of the sample? (6)
- 8 A group of atoms held together by covalent bonds. (8)
- 9 Cholesterol is an example. (7)
- 11 Has a strong carbolic smell and gives a white precipitate with excess bromine water. (6)
- 13 Suffix for an alcohol. (2)
- 15 Like groups on the same side of the polymer chain. (9)
- 17 An organic acid found in rape seed oil. (6)

- 22 A group containing five carbon atoms and five hydrogen atoms. (6)

- 23 A device which produces direct current by oxidising hydrogen to water. (8)

- 24 A phenol present in clove oil. (7)

### Down

- 1 The scientist who first said that, in a liquid mixture the vapour pressure of one of the components above the mixture equals the mole fraction of that component times the vapour pressure of the pure component. (6)
- 2 Produced when two alpha-amino acids are joined together. (9)
- 4 Name of ammonia ligand. (6)
- 5 Crabs claw. (7)
- 7 The shape of the P<sub>4</sub> molecule. (9)

- 10 The burette should be treated in this way (with the titrant) before commencing the titration (6,3). (9)

- 12 [Xe]4f<sup>14</sup>,5d<sup>10</sup>,6s<sup>2</sup>,6p<sup>2</sup> (4)

- 14 This group I metal forms a nitride. (7)

- 15 When bidentate ligands replace monodentate ligands, in a chemical reaction, the entropy changes in this way. (8)

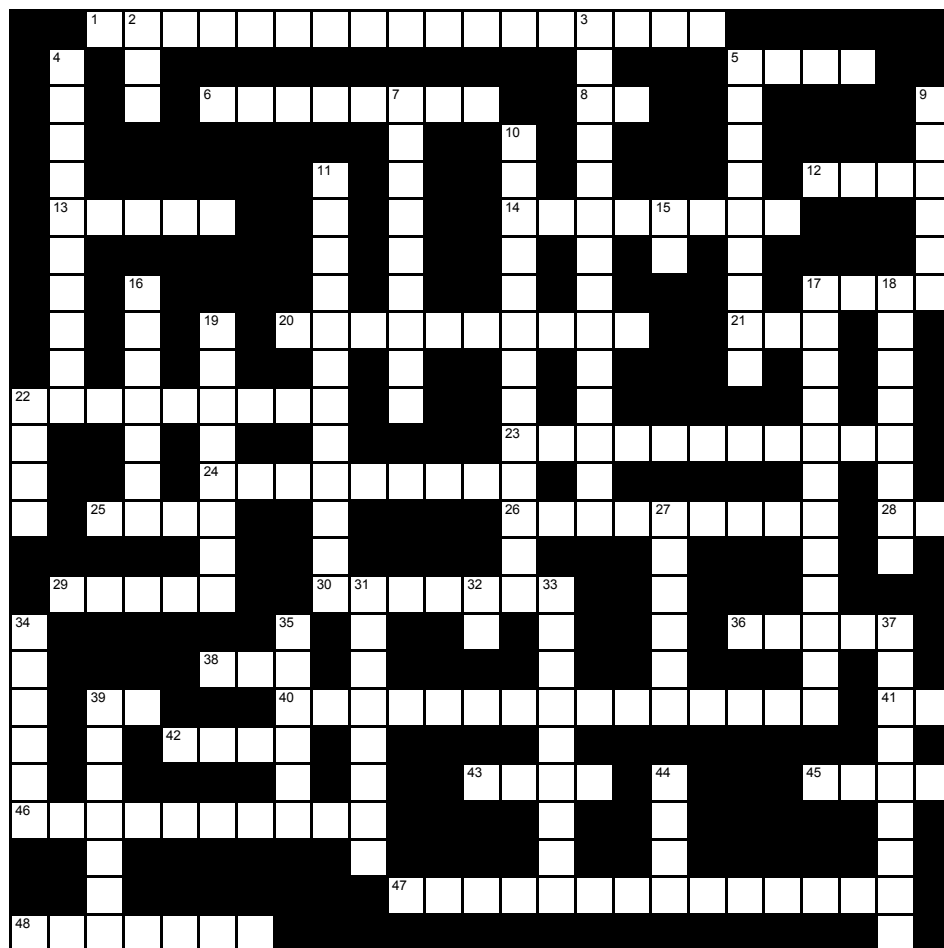
- 16 Suffix for a carboxylic acid. (3)

- 18 The common name for 2-phenylpropane. (6)

- 19 Propane-1,2,3-triol is an example. (6)

- 20 The pOH of an aqueous solution whose pH is ten. (4)

- 21 A balanced equation showing part of a redox reaction. (4)



**Across**

- 1 Shape of the phosphorus pentachloride molecule (8,9). (17)
- 5 Calcium oxide. (4)
- 6 Formed when a compound containing the  $\text{CH}_3\text{CO}$  group is warmed with aqueous KI and NaOCl solution. (8)
- 8 Iodine is sparingly soluble in water but much more soluble in an aqueous solution of this salt. (2)
- 12 This is what happens when hydrogen is ignited. (4)
- 13 Consider the dissociation of phosphorus pentachloride at elevated temperature. How many partial pressure terms are there in the expression for  $K_p$ . (5)
- 14 This describes phosphoric acid. (8)
- 17 Next in the series, LiCl, NaCl, KCl, RbCl? (4)
- 20 White and grey tin. (10)
- 21 An alkali metal salt containing a hydride ion. (3)
- 22 Dissolves in dilute hydrochloric acid and in sodium hydroxide solution giving hydrogen. (9)
- 23 The shape of the silicon tetrachloride molecules. (11)
- 24 An equilibrium mixture contains 0.8M hydrogen iodide, 0.1M hydrogen, 0.1M iodine where reaction between hydrogen and iodine. Calculate a value for  $K_c$  (5,4). (9)
- 25 The formula of a chloric acid. (4)
- 26 Solubility of silver chloride in water. (9)
- 28 The next in the series, B, C, N, O, F, Ne. (2)
- 29 This gas helps prevent harmful radiation reaching the earth's surface. (5)
- 30 A group of compounds formed between silicon and hydrogen. (7)
- 36 An important product derived from sand. (5)
- 38 The condition of the materials used in the preparation of Grignard reagents. (3)
- 39 A flammable, toxic, gas. (2)
- 40 Mole fraction multiplied by total pressure (7,8). (15)
- 41 The least reactive of the alkali metals. (2)
- 42 A solution of this forms a blood red colour with aq iron(III). (4)
- 43 When one mole of magnetite is reduced to iron by reaction with carbon, how many moles of carbon monoxide are formed? (4)
- 45 When a solution of silver nitrate is added to brine this compound is precipitated. (4)
- 46 Produced when ammonia and

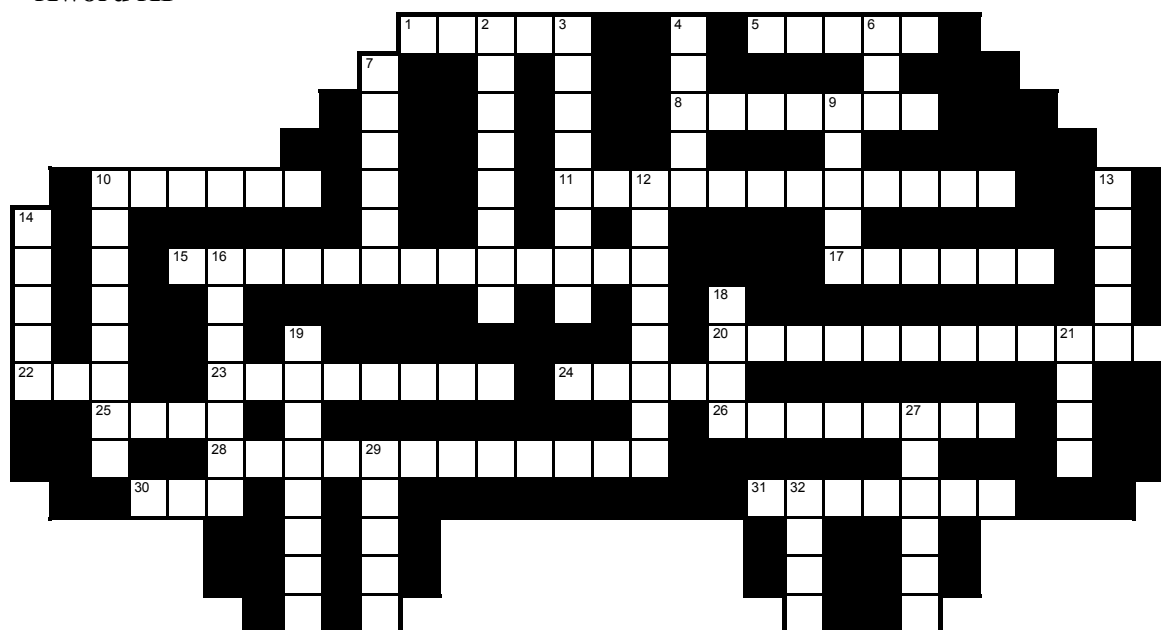
hydrogen chloride are mixed. (10)

- 47 Unlike carbon dioxide it does not form discrete molecules (7,7). (14)
- 48 This gas is very soluble in water producing an alkaline solution. (7)

**Down**

- 2 The colour of lead(II IV) oxide. (3)
- 3 These have two s electrons in their outer shells (8,6). (14)
- 41 Bromobutane and 2-bromobutane are examples of this type of structural isomerism (10)
- 5 Application of graphite related to structure. (9)
- 7 This is particularly strong in the case of Al and helps prevent the metal corroding (5,4). (9)
- 9 SI unit of pressure. (6)
- 10 Gives butanoic acid when boiled with dilute HCl. (13)
- 11 The electronegativities of these metals are low and they react with water vigorously (6,6). (12)
- 15 The missing element, Ga, Ge, Se. (2)
- 16 A form of sulphur stable at room temperature. (7)
- 17 Formed when phosphorus(V) chloride reacts with ethanol. (12)
- 18 Poor agreement between experimental and theoretical lattice energies indicates this type of bonding in silver bromide. (8)
- 19 The common oxidation state of the halogens (5,3). (8)
- 22 The smallest particle of an element. (4)
- 27 Arrangement of carbon atoms in graphite. (6)
- 31 Applying pressure, in the Haber process, has this effect on the yield of ammonia. (8)
- 32 This oxide of nitrogen has 11 electrons available for bonding. (2)
- 33 When mixed with concentrated nitric acid it produces a solution containing the nitronium ion. (9)
- 34 Latin name for red lead. (6)
- 35 Used to make plaster of Paris. (6)
- 37 May be formed by the hydrolysis and condensation of silicon alkyls. (9)
- 39 This element has the electronic structure  $(\text{Xe})6s^1$ . (7)
- 44 In group four. (4)

## Xword XI



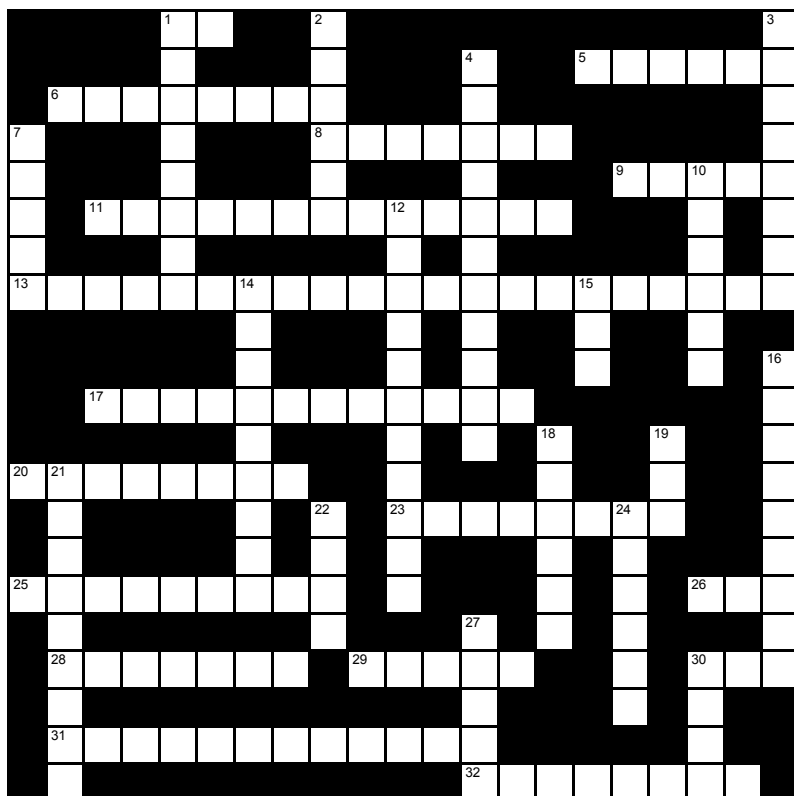
### Across

- 1** It rains sulphuric acid on this planet. (5)
- 5** A mixture of iron and copper sulphides formed during the extraction of copper. (5)
- 8** Alkenes. (7)
- 10** Formed when CuO is reacted with hydrogen. (6)
- 11** The reaction of bromine with iodide is an example of this type of reaction. (12)
- 15** Very large molecule. (13)
- 17** Fats, vegetable oils, steroids are examples of this broad class of biological compounds. (6)
- 20** Alleviate fatigue. (12)

- 22** The number of position isomers with the molecular formula  $C_2H_4Cl_2$ . (3)
- 23** Mercury combined with other metals. (8)
- 24** Reacting the amide ion with nitrogen(I) oxide produces this nitrogen rich ion. (5)
- 25** This metal produces green and yellow ions. (4)
- 26** This applies to water and ethanol. (8)
- 28** This occurs when dilute hydrochloric acid is added to sodium carbonate solution. (12)
- 30** Smells of bad eggs (1,2,1)! (3)
- 31** Like ethene, this alkene does not exhibit geometrical isomerism. (7)

### Down

- 2** All of these compounds are soluble in water. (8)
- 3** A transition element whose oxide was discovered in Sweden in 1879. (8)
- 4** A vertical column of elements in the periodic table. (5)
- 6** Not tin but a transition metal nitride? (3)
- 7** The sulphate of this metal finds application in medicinal X-ray work. (6)
- 9** We say this of mixtures which obey Raoult's law. (5)
- 10** A fossil fuel (5,3). (8)
- 12** Extraction of metals from their ores using heat. (8)
- 13** How many moles of carbon monoxide are required to reduce one mole of iron(III) oxide to metal and carbon dioxide? (5)
- 14** Can be used to stop iron corroding. (5)
- 16** These react with chlorine in the presence of sunlight to form substitution compounds. (7)
- 18** Four of these groups make up the red globular protein which is present in blood. (4)
- 19** Copper dipping into copper(II) solution is an example. (8)
- 21** This hydroxide is deliquescent. (4)
- 27** Decolourises dyes. (6)
- 29** The reaction between zinc and silver(I) is an example. (5)
- 32** Change in concentration of reactant(s) in unit time. (4)



## Xword XIII

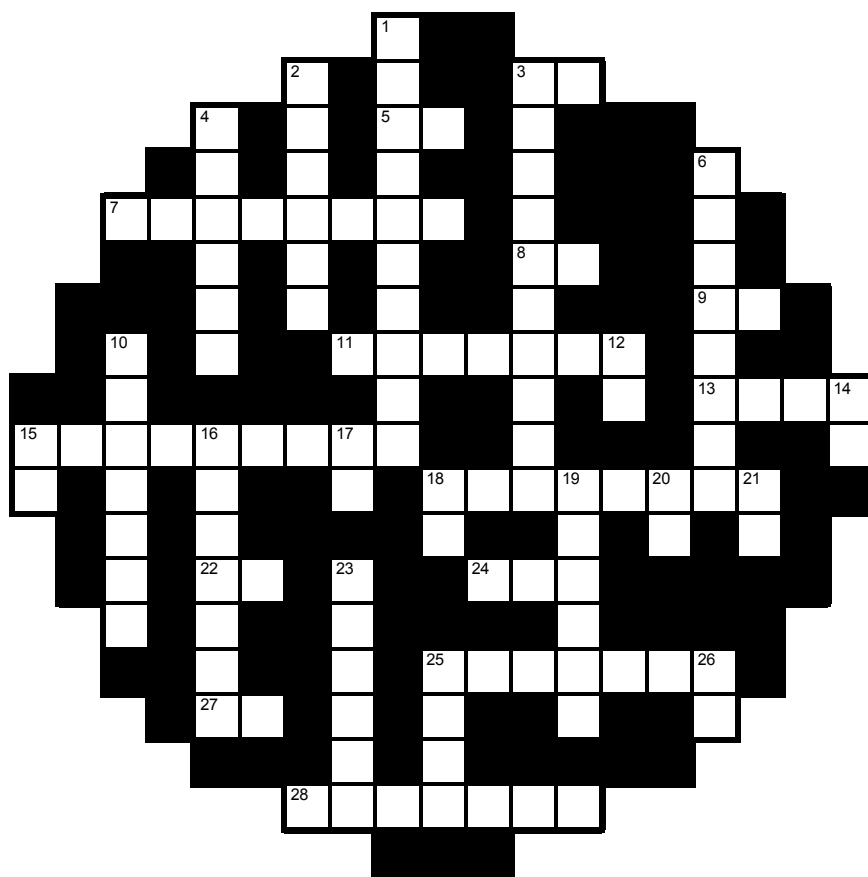
### Across

- 1** Burns in air with a blue flame. (2)
- 5** A class of compound used in nmr spectroscopy as internal standard. (6)
- 6** This group shows strong and broad absorption, in the ir, at about  $3400\text{ cm}^{-1}$ . (8)
- 8** Randomness of a reacting system. (7)
- 9** The colour of lead(II) hydroxide. (5)
- 11** A common name for phenylmethanol (6,7). (13)
- 13** Formed when bromoethane reacts with magnesium. (21)
- 17** Used to measure the age of archeological objects (6,6). (12)
- 20** In ir spectroscopy liquids are often examined between plates of this material (4,4). (8)

- 23** The trend in bond dissociation energies in the series,  $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$ . (8)
- 25** Natural raw material for making plastics. (9)
- 26** Litharge and massicot. (3)
- 28** A form of tin which has the diamond structure (4,3). (7)
- 29** Silicon tetrachloride exhibits this behaviour in moist air. (5)
- 30** A type of spectroscopy concerned with the magnetic properties of atomic nuclei. (3)
- 31** Converts iodine to iodide. (12)
- 32** These absorb strongly in the ir at about  $2250\text{ cm}^{-1}$ . (8)

### Down

- 1** A group which absorbs in the infra red at about  $1700\text{ wavenumbers}$ . (8)
- 2** The main ore of lead. (6)
- 3** Change in entropy when nitrogen and hydrogen combine to form ammonia at a particular temperature. (8)
- 4** Pressure, in atmospheres, required to make polyethene from ethene (3,8). (11)
- 7** The number of covalent bonds in a nitrogen molecule. (5)
- 10** A sealed glass tube containing a violet vapour was rapidly cooled. The violet colour disappeared and the tube contained a brown solid. Name the substance in the tube. (6)
- 12** The main ore of tin. (11)
- 14** A type of pressure cooker. (9)
- 15** Hydroxy alkane (formula). (3)
- 16** An equilibrium mixture, produced from hydrogen and iodine at elevated temperature, contained  $0.367\text{ mol}$  hydrogen iodide,  $0.05\text{ mol}$  hydrogen and  $0.05\text{ mol}$  iodine. What is the value of  $K_c$  (5,4)? (9)
- 18** Arrest a reaction. (6)
- 19** Methyl protons absorb at about this ppm value in pmr spectra. (3)
- 21** The bond angle in beryllium chloride. (9)
- 22** A type of calorimeter used to measure heats of combustion. (4)
- 24** Used to test for iodine. (6)
- 27** In the pmr spectrum of an aromatic compound the phenyl group absorbs at approximately this ppm value. (5)
- 30** The number of carbon atoms in the propiophenone molecule. (4)



## Xword XII

### Across

- 3 Its main ore is pyrolusite. (2)  
 5 Used in situations where extreme hardness and high melting point are required. (2)  
 7 This important metal alloy contains cobalt, tungsten, chromium and molybdenum. (8)  
 8 Atomic number 76. (2)  
 9 Used in gas filled electric light bulbs. (2)  
 11 Sometimes its salts are used to treat bipolar disorders. (7)  
 13 [Ar], 3d<sup>6</sup>, 4s<sup>2</sup> (4)  
 15 Sulphur (9)  
 18 A furnace used to make iron. (8)

22 Plumbum. (2)

24 A covalent compound which forms a crystalline solid at -111°C. (3)

25 The element exists in three allotropic forms and, both as the element & in its compounds, is highly poisonous. (7)

27 A naturally occurring radioactive element. Occurs in areas underlain by granite, eg, Cornwall. (2)

28 Element 100. (7)

### Down

1 Approximate percentage sodium in sodium chloride. (10)

2 Percentage carbon in calcium carbonate. (6)

3 These consist mostly of iron. (10)

4 The number of neutrons in a potassium atom. (6)

6 [Xe], 4f<sup>14</sup>, 5d<sup>10</sup>, 6s<sup>2</sup>, 6p<sup>5</sup> (8)

10 A man-made radioactive isotope of hydrogen. (7)

12 1s<sup>2</sup>, 2s<sup>2</sup>, 2p<sup>6</sup>, 3s<sup>2</sup>. (2)

14 Headache metal (2)

15 Glucinum. Hard, white, metal (2)

16 Extracted from natural deposits by the Frasch process. (7)

17 Discovered by William Ramsay in 1898. (2)

18 This element was discovered in 1826

by Antoine Balard. It is harmful to human tissue & must not be inhaled. (2)

19 A metal associated with photography. (6)

20 From the Greek, molybos, meaning lead! (2)

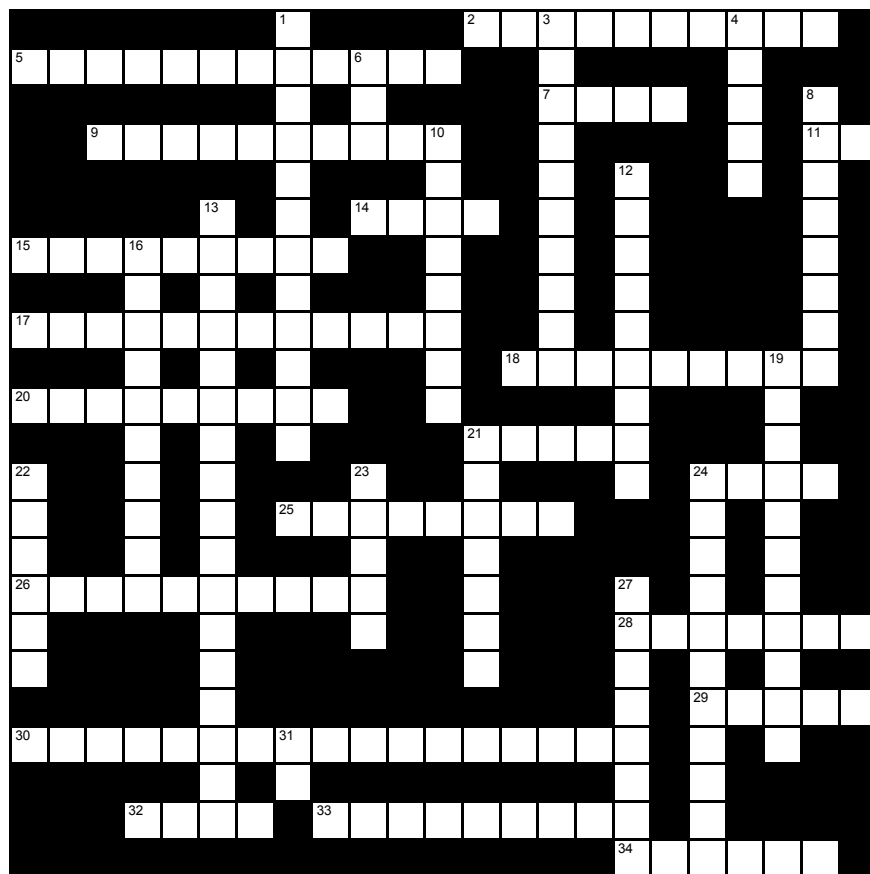
21 Chemically resembles barium. Isolated from pitchblende in 1898 by the Curie's. (2)

23 Tinctures of this element are good germicides. (6)

25 A double salt of potassium and aluminium. (4)

26 Occurs as calcite (2)

## Xword XIV



### Across

- 2** Butan-1-ol (5g) was reacted with sodium bromide and sulphuric acid to give 4g of pure 1-bromobutane. What was the % yield (5,5)? (10)
- 5** In permanganate titrations, under acid conditions, five electrons are taken up as permanganate is reduced to this ionic state (9,3). (12)
- 7** The colour of anhydrous cobalt(II) chloride. (4)
- 9** Introduced as an anaesthetic in 1846 by Dr Simpson. No longer used for this purpose. (10)
- 11** A type of spectroscopy which examines electronic transitions in molecules. (2)
- 14** Synthesised from glycerol and long chain carboxylic acids. (4)

- 15** Anti cancer drug. (9)
- 17** In close packed metallic structures this number is 12. (12)
- 18** Stability of the +2 oxidation state down group 4. (9)
- 20** Pain killer. (9)
- 21** The colour of manganese(IV) oxide. (5)
- 24** The colour of the Mn (II) ion. (4)
- 25** A commercial epoxy resin adhesive. (8)
- 26** The reactivity of tetrachloromethane towards water. (10)
- 28** A mixture of equal amounts of dextro and laevo rotatory butan-2-ol. (7)
- 29** The number of alkenes with the molecular formula  $C_4H_8$ . (5)
- 30** A reaction does not take place even though it is feasible (11,6). (17)

- 32** Internally compensated tartaric acid. (4)
- 33** A sweetener. (9)
- 34** Silicon tetrahydride. (6)

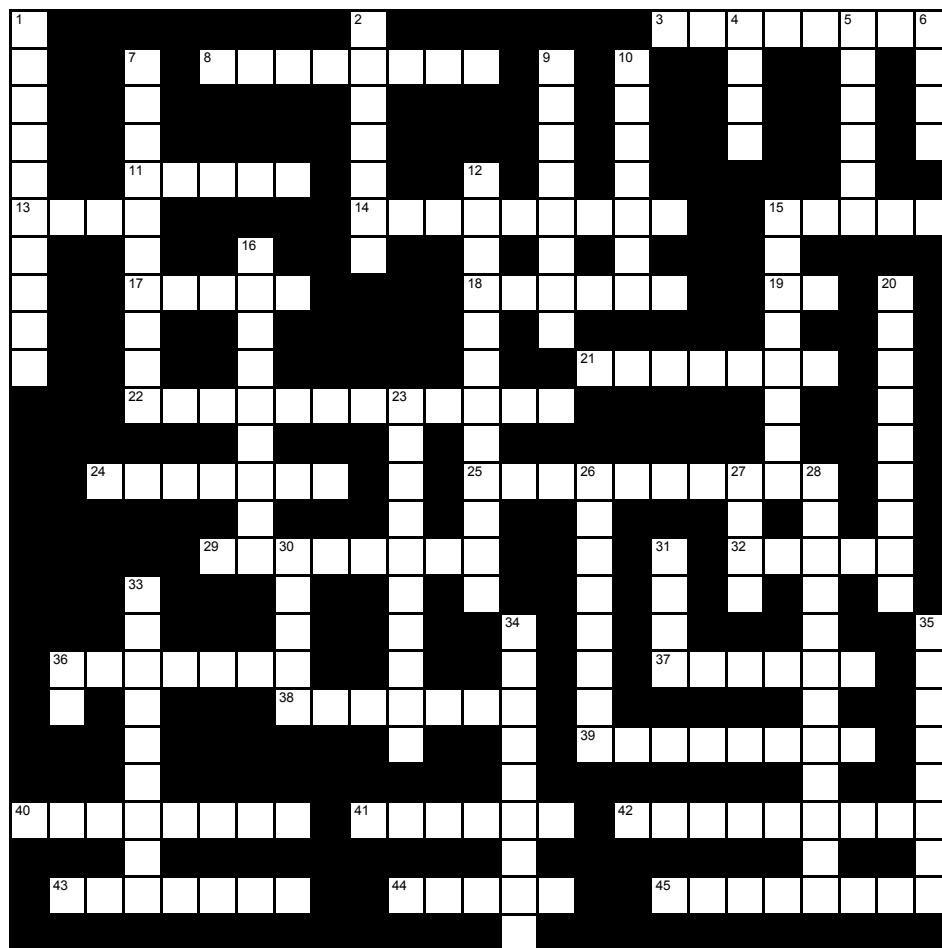
### Down

- 1** Vitamin C. (8,4)
- 3** Vitamin B<sub>2</sub>. (10)
- 4** The reactant, HI, is in equilibrium with hydrogen and iodine. HI is added. The equilibrium moves in this direction. (5)
- 6** The number of stereoisomers formed when hydrogen bromide reacts with but-2-ene. (3)
- 8** A solid vapourises without first melting. (8)
- 10** The thermosetting plastic, bakelite, is made from phenol and this simple organic molecule. (8)

- 12** A food stuff manufactured by reducing vegetable oils. (9)
- 13** Factor related to the decrease in lattice enthalpies in the series:  $AgF > AgCl > AgBr > AgI$  (6,5,6). (17)
- 16** Black mineral of manganese. (10)
- 19** Optically active mirror image forms. (11)
- 21** Impure copper. (7)
- 22** Physical state of phosphorus(III) chloride. (6)
- 23** A milky fluid from the rubber tree, *Hevea brasiliensis*. (5)
- 24** Synthesised from 4-aminophenol and ethanoic acid. (11)
- 27** Synthesised from amino acids. (8)
- 31** The most abundant metallic element in the earth's crust. (2)



## Xword XV



### Across

- 3 Large scale production of alkenes. (8)  
 8 A bromine molecule. (8)  
 11 The number of methyl groups in, 2-chloro-4-methylpentane. (5)  
 13 Secondary alcohol group. (4)  
 14 Converting a higher oxidation state into a lower oxidation state. (9)  
 15 Contains two carbon-carbon double bonds. (5)  
 17 Type of reaction of chlorine with water. (5)  
 18 Flaming cyclohexene. (6)  
 19 This oxide converts iron(III) oxide to iron and carbon dioxide. (2)  
 21 Copper atoms having lost electrons. (7)  
 22 Free radical (8,4). (12)  
 24 In order for molecules to react they must? (7)  
 25 Produced when PVC is burnt (5,5). (10)  
 29 We say this is how molecules enter the ionisation chamber of a mass spectrometer (4,4). (8)  
 32 Oxidation number of manganese in permanganate. (5)

### Down

- 36 Salt maker. (7)  
 37 We say that it is difficult to do this to carbon atoms attached to one another by a double bond. (6)  
 38 This compound is very pungent and smells of rotten apples. Its molecule contains two carbon atoms, four hydrogen atoms and an oxygen atom. (7)  
 39 A tetrahedral, sulphur containing, anion. (8)  
 40 Ethyl ethanoate is isomeric with this acid. (8)  
 41 Used to make electrical contact. (6)  
 42 The colour of nitrogen(IV) oxide (4,5). (9)  
 43 It is sometimes depicted as Kekule structures. (7)  
 44 In the preparation of cyclohexene from cyclohexanol why is it necessary to add calcium chloride in the final stage? (2,3). (5)  
 45 Ethene is produced by cracking a distillation fraction of this substance (5,3). (8)

### Across

- 1 This acid is a weak acid but stronger than ethanoic acid. (10)  
 2 Ionising electrons do this to molecules in the mass spectrometer. (7)  
 4 Some of these insects produce formic acid for defence purposes. (4)  
 5 Which has the largest atom in the solid element, cobalt or iodine? (6)  
 6 Hydrogen peroxide and hydrazine. A good or poor rocket propellant? (4)  
 7 The heat change when propene is hydrogenated. (10)  
 9 The type of reaction occurring when alkenes react with bromine. (8)  
 10 Oxidation number of Group I elements in their compounds. (7)  
 12 The type of reaction occurring when ethane reacts with bromine. (12)  
 15 If you were to dissolve hydrated copper(II) sulphate in water would the temperature increase or decrease. (8)  
 16 The nature of pure hydrogen peroxide. (9)  
 20 Chlorine is one of these agents

in its reaction with hydrogen. (9)

23 This is its formula, CHOCHO. (10)

26 Atoms with the same number of protons but different numbers of neutrons. (8)

27 Adding sulphur trioxide to water produces this physical phenomenon. (4)

28 Express 59.9g of cyclohexene as a % of one mole. (12)

30 This class of compound contains an NRR group where R represents hydrogen and/or alkyl groups which can be the same or different. (5)

31 If you were to write the ionic equation for the reaction of potassium with bromine how many ions would the equation contain? (4)

33 Teamed up with Maxwell. (9)

34 Sodium nitrate. (9)  
 35 In aqueous solution it is used to preserve biological specimens. (8)

36 Which requires most energy, the breaking of the HH bond or the breaking of the FF bond? (2)

SOLUTIONS:

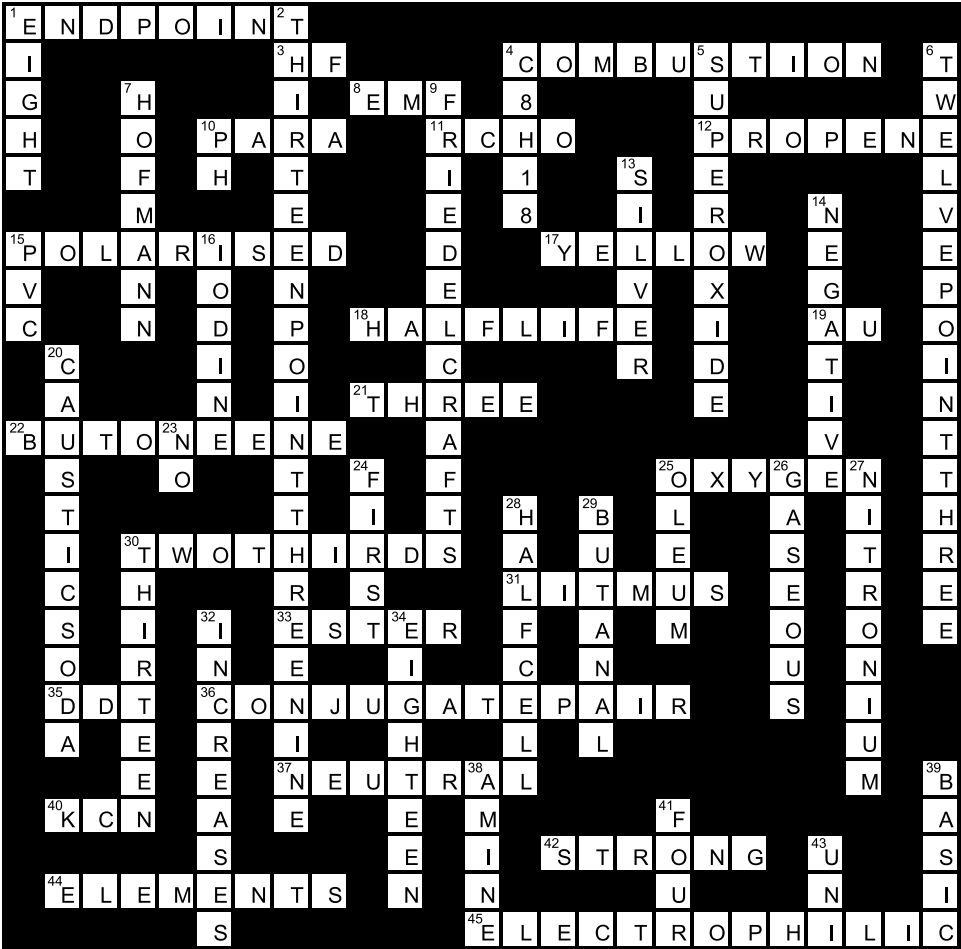
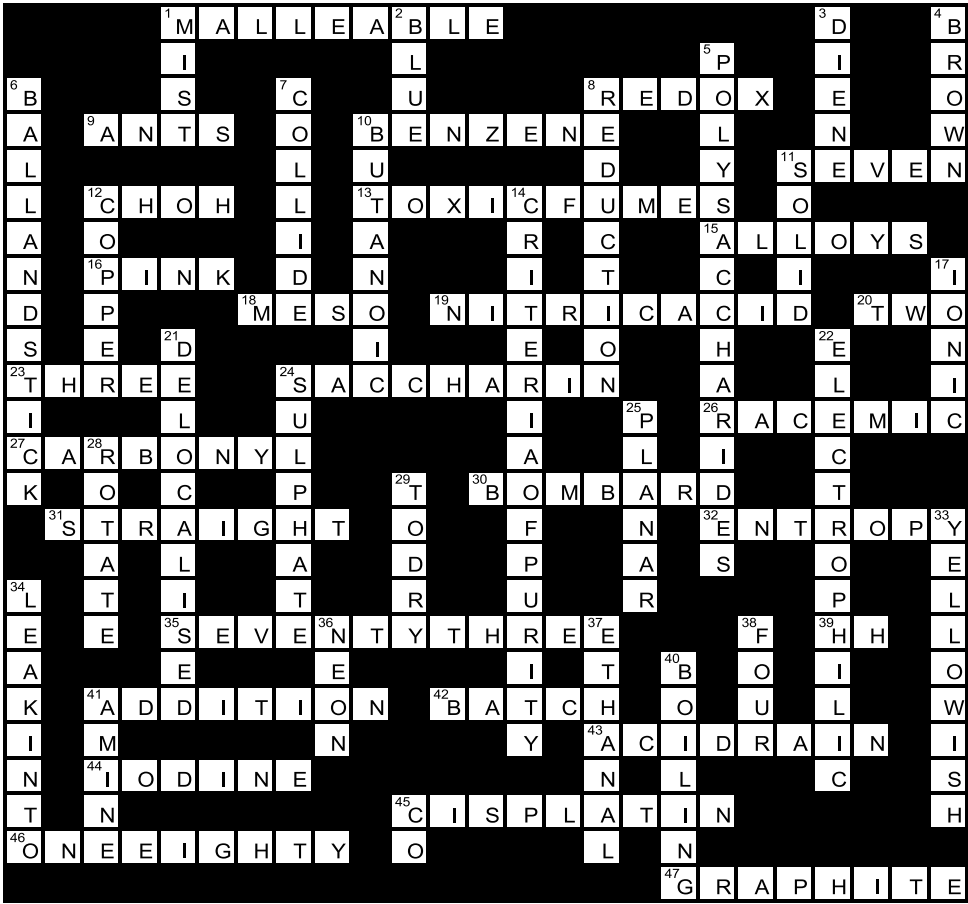
Xword I

1 C 2 T  
R H  
4 I U R  
5 P S C E  
6 L I M O N I T E  
A M B  
S E 7 L A C T I C A C I D  
9 P O I N T T H R E E E T 10 N  
I E S 11 M A L T O S E U  
13 M O R T A R R 14 H E I C  
A C O A 15 L 16 N I T R 17 O C H A L K  
L H F F I T R C E  
T 18 P I N K I N G E T 19 C A U S T I C  
21 F O R M U L A I E A R S N  
N R U R E A 24 B 25 K O H Y D  
E 26 B A R I U M R O E S 28 C U R I E  
P Z S R D T O G  
P O O R D E R A P O  
M L E  
30 N I T R E

Xword II

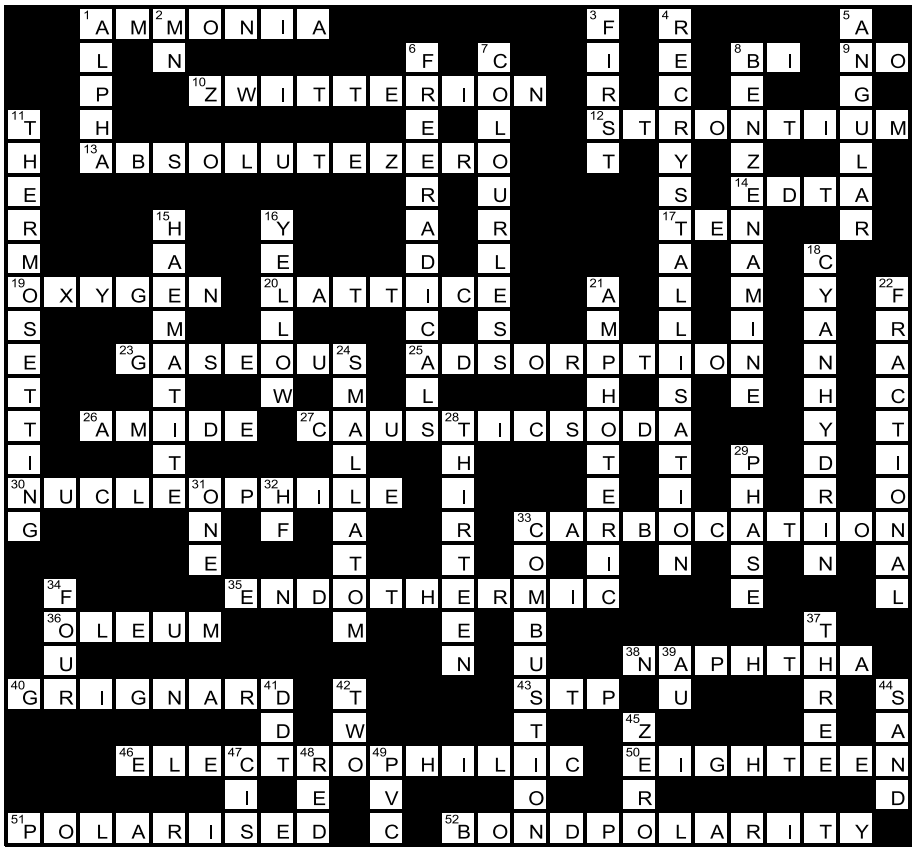
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13 N I N E 14 E N T R O P Y 15 B A T C H M R U S T  
A N B S E 19 A M I N E Y  
20 A M P H O T E R I C 21 A M I D E E C 22 D I O L  
C H S C C N 23 M N U C  
I T E N A C P A C 25 C H O H  
D H 27 S C 28 C H L O R O E T H A N E L  
I A 29 U N I A I I L D O  
30 C O 31 P 32 L D 33 D E P R O T O N A T I O N R  
36 L I R 37 P H I I W T E R 38 S I  
E O H G D O T I I D  
U 39 P L U S T H R E E H F G E  
M E R T S 40 B E R R Y L I U M  
N 41 O N E E C A 42 F  
43 S O L D E R 44 E M F E 46 B V L  
U E 47 K C N 48 D N E 49 A U U  
50 L E A D 51 D I F R A C T I O N A L 53 M O  
P K D T N Z U A R  
H I 54 T R A N S I T I O N E L E M E N T S S  
A N C A R V N E 59 S T P  
60 T E T R A C H L O R O M E T H A N E 61 62 O A  
E O O H N F O 63 K C N S R

Xword III

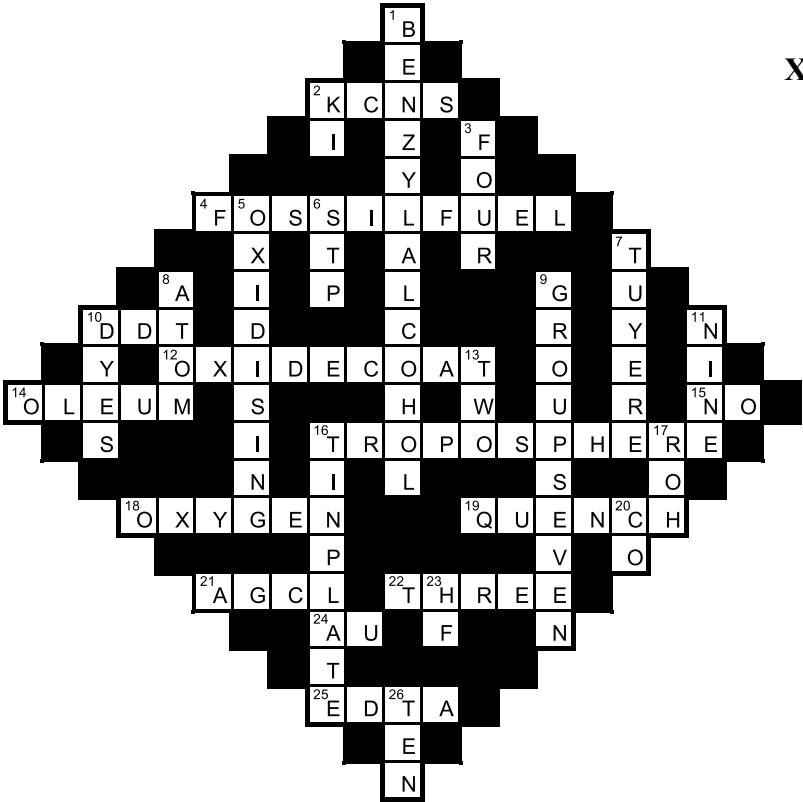


Xword IV

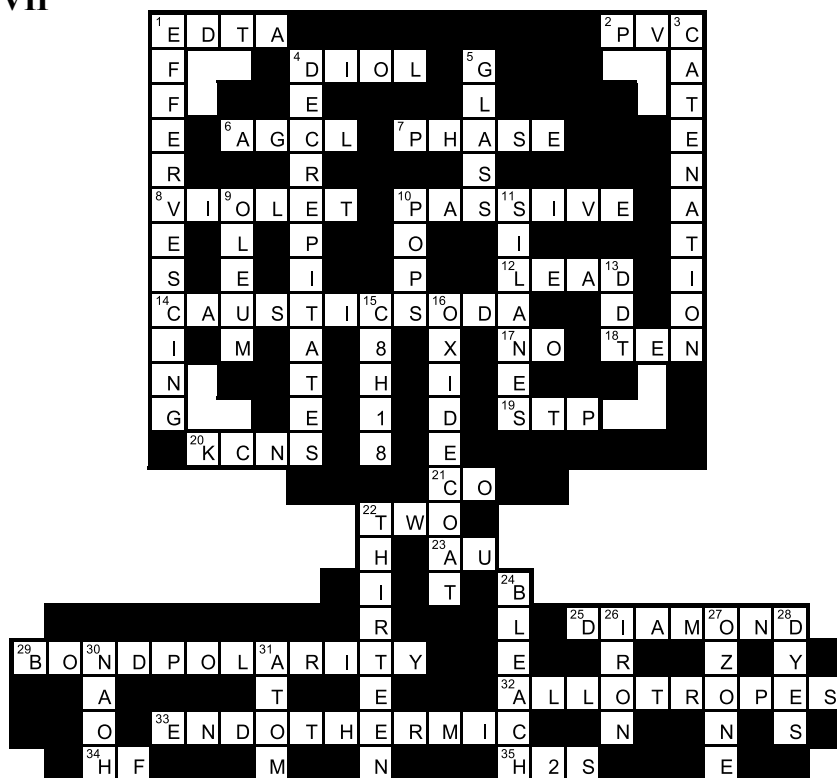
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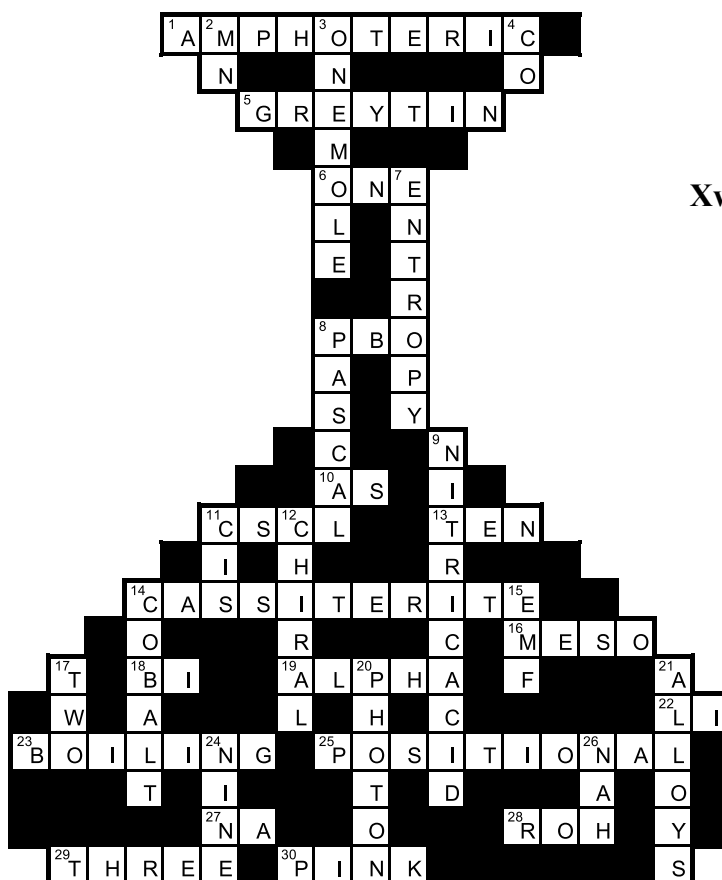
**Xword VI**



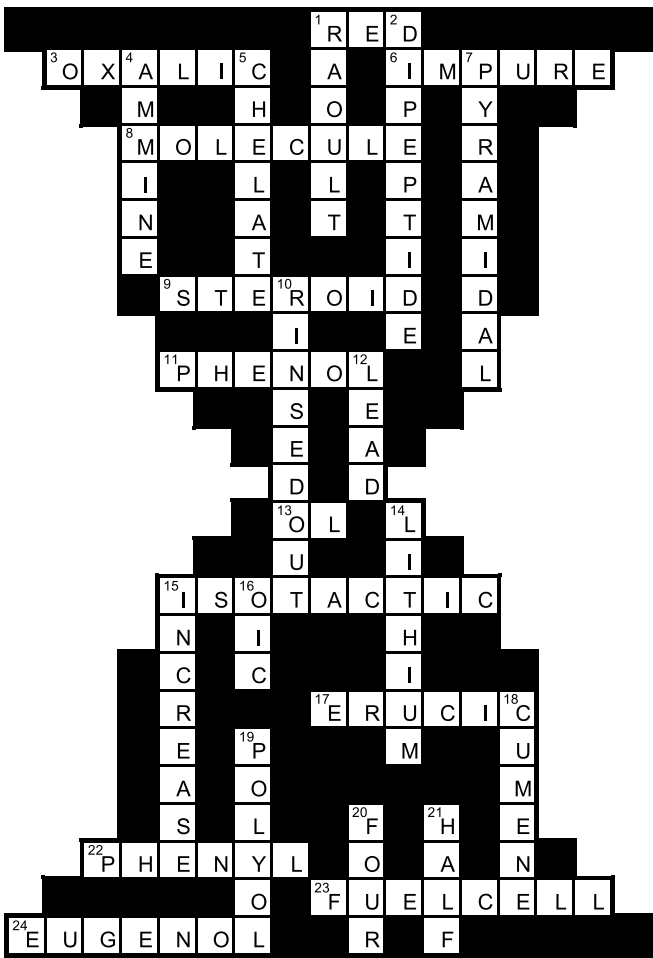
## Xword VII



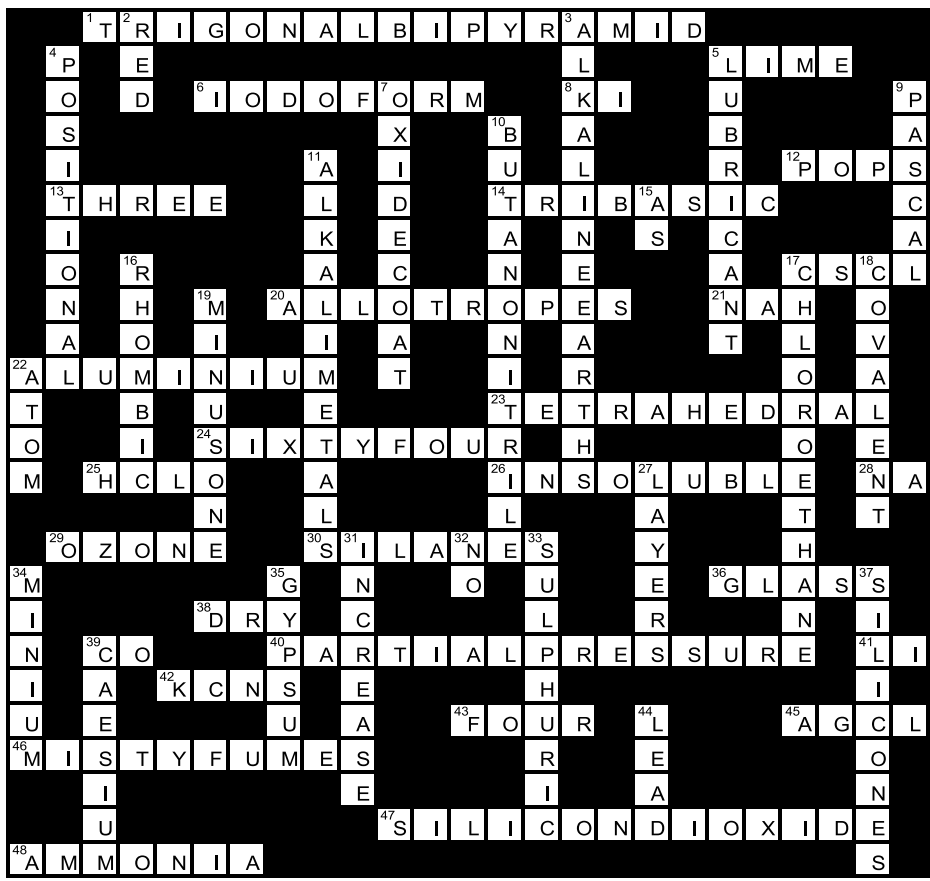
## Xword VIII



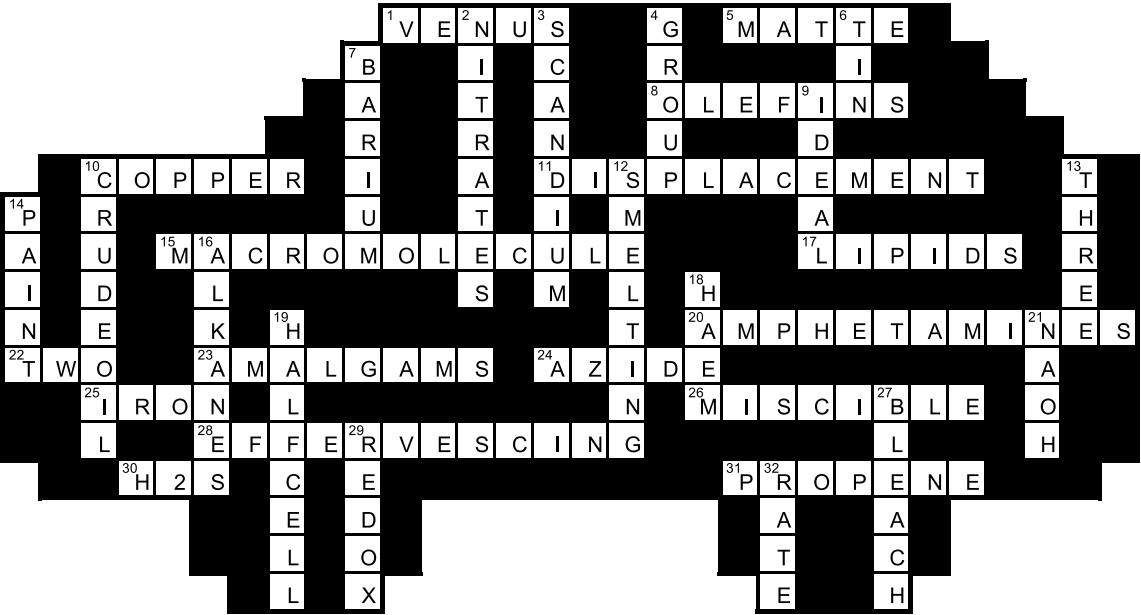
Xword IX



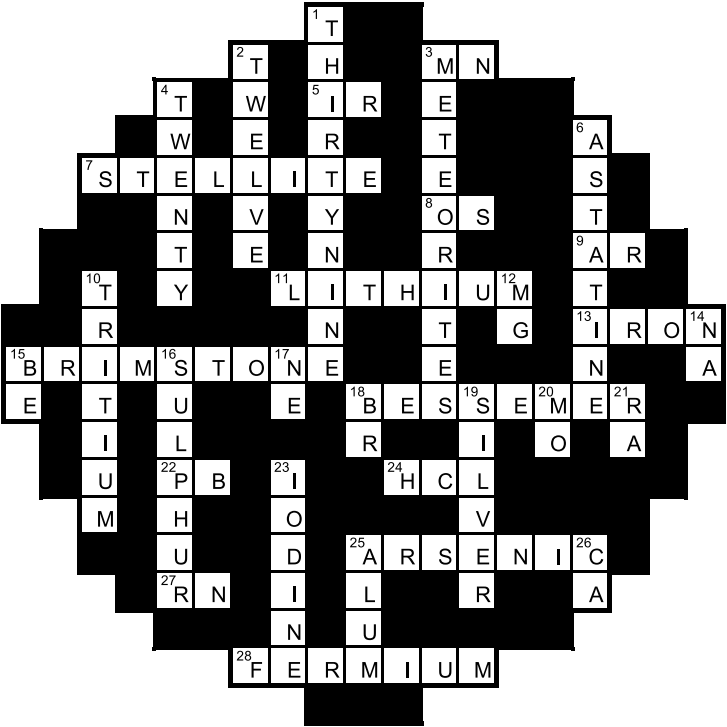
Xword X



**Xword XI**



**Xword XII**



Xword XIII

1 C O 2 G 3 D

A A T 5 S I L A N E

6 H Y D R O X Y L W C

7 T B 8 E N T R O P Y R

H O N T 9 W H 10 I T E

11 B E N Z Y L A L 12 C O H O L O A

E Y A O D S

13 E T H Y L M 14 A G N E S I U M B 15 R O M I D E

U S S O N

T I A H E 16 F

17 C A R B O N D A T I N G I

C E D 18 Q 19 O F

20 R O C K S A L T R U N T

N A 22 B 23 I N C R E A 24 S E Y

E V O T N T F

25 P E T R O L E U M E C A 26 P B O

I B 27 S H R U

28 G R E Y T I N 29 F U M E S C 30 N M R

H V H I

31 T H I O S U L P H A T E N

Y 32 N I T R I L E S

Xword XIV

1 A 2 F O R T Y T H R E E 3

5 M A N G A N E S E 6 T W O I I

C W 7 B L U E G 8 S

9 C H L O R O F O R M 10 O H U V

R E F M T B

13 H B 14 F A T S L A L

15 C I S 16 P L A T I N H A R I

Y L C A V G M

17 C O O R D I N A T I O N I A E

O D C A 18 I N C R E A S 19 E S

20 A N A L G E S I C L I N

U I D 21 B R O W N A

22 L S O 23 L L E 24 P I N K

I I N 25 A R A L D I T E A T

Q T I T S R I

26 U N R E A C T I V E T P A O

I R X E 27 R A C E M I C

D A R O E E

D T 29 T H R E E

30 K I N E T I C 31 A L L Y S T A B L E A S

U L I M

32 M E S O 33 S A C C H A R I N O

34 S I L A N E



# Xword XV

